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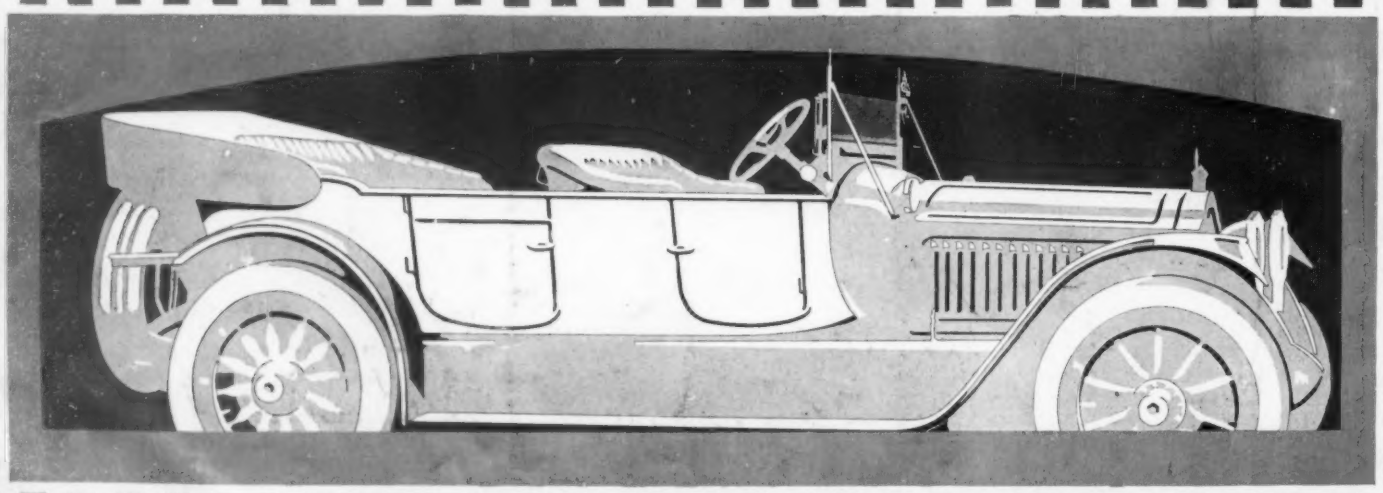

SEVENTY-FIRST YEAR

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THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIII. NUMBER 6

NEW YORK, AUGUST 7, 1915

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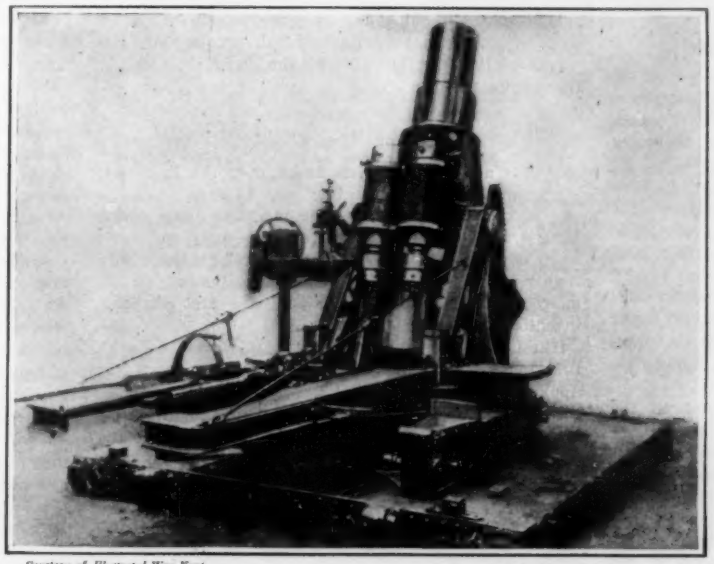
Photograph by Underwood & Underwood

German prisoners making wooden shoes in a French concentration camp.

A dummy gun set by the Austrians to fool the enemy.

Photograph by Dr. Alfred Gradenwitz

The catapult has come into its own again as a bomb thrower.

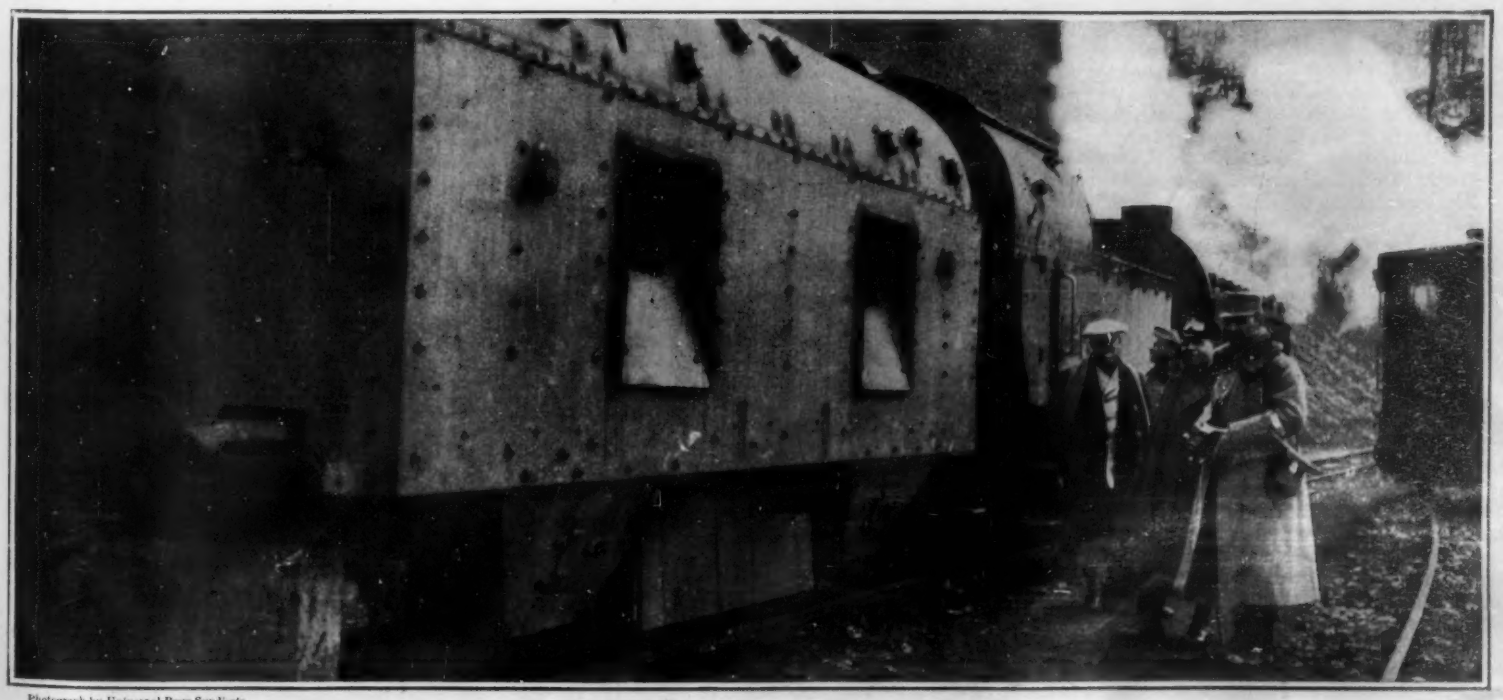


Courtesy of *Illustrated War News*

The famous 12-inch Skoda. Its range is so great that an enemy would have to march two hours to capture it.

Courtesy of *Illustrated War News*

The new French steel helmet protects against shrapnel.



Photograph by Universal Press Syndicate

An Austrian armored train in the Carpathians.

BEHIND THE SCENES OF THE THEATER OF WAR

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, AUGUST 7, 1915

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

We Should Build Battle-Cruisers

ACCORDING to the *Army and Navy Journal* "it would not be surprising if six battle-cruisers were included in the naval programme which the General Board will recommend to the Secretary early this fall."

Generally speaking, the policy of the Board has been opposed to the construction of battle-cruisers—this for the reason that the final issues of a naval war will be decided when the rival battleships meet and fight to a finish in a general engagement. The Board has argued that only heavily-armored battleships could "lie in line" with any hope of surviving an accurate gun-fire from the enemy. In this the Board had behind it the practically unanimous opinion of the Navy, including that of the naval constructors.

If the General Board should now recommend the building of battle-cruisers, would this be a reversal of policy? Not by any means; for the Board has been guided in its recommendations by the experience of actual warfare in the past, and the battle-cruiser, until this war broke out, was largely an experiment. Congress, it well knew, would cut down such recommendations as were made, and it was the opinion of the Board that these limited appropriations should be put into ships of the line, heavily gunned and heavily armored, rather than into swift and lightly armored battle-cruisers. In recommending, if it should do so, the construction of battle-cruisers, the Board would be following out its policy of being guided by the actual experience of war, and it would be voicing the opinion of a rapidly growing majority among our naval officers.

It must certainly be admitted that in the actual fighting which has occurred on the high seas, the battle-cruiser has more than redeemed the promises made for it by its sponsors. In the battle off Helgoland, early in the war, it was Admiral Beatty's battle-cruisers which dashed in to the rescue of the hardly pressed British light cruisers and sank three of the light cruisers of the enemy. This they did in a sea which was infested with torpedoes, against which their high speed and quick turning power proved an efficient defense. Had Great Britain possessed no ships of this type, the German battle-cruisers would have ravaged the undefended coast of Great Britain at will, or they could have broken through the cordon of blockading cruisers and created havoc among the merchant fleets of the Allies.

Admiral von Spee with the "Scharnhorst" and "Gneisenau" and the accompanying German light cruisers might have been roaming the seas even yet had not Great Britain possessed a fleet of battle-cruisers, two of which, as soon as they were dispatched to the theater of operations quickly found von Spee and sent his fleet to the bottom.

Thirty knots will be the standard speed for the battleship of the future; and if we fail to build any, how will our battleships, with an average speed of some nine or ten knots less, be able to protect our long coast line against an enemy possessing a fleet of these swift and powerfully gunned ships? The Spanish-American war is not so far removed in history but that many of us recall the frantic fear of some of our Atlantic Coast cities, when it was learned that Cervera had set sail for our coasts. Members of Congress were besieged by importunate citizens who demanded that the fleet or a part of it, a battleship, a cruiser, or anything that could fight, be sent to guard them against attack. Today, there would be a similar anxiety, intensified by the knowledge of the fact that our twenty-one knot battleship fleet would be powerless to annihilate, because it could never get within range of a thirty-knot battle-cruiser fleet.

We had an instructive lesson in the need for ships of this type in the recent maneuvers off the Atlantic coast which followed the review at New York. The defending fleet had thrown out its scouts—such as they were—in the endeavor to get in touch with the approaching enemy; but these scouts were so slow and so limited in gun-fire that the moment they came in touch with the battle-cruisers of which the invading fleet had several, they were either sunk or driven in upon the main fleet, to which the survivors returned with absolutely no information as to the composition or whereabouts of the enemy. As a matter of fact, throughout the whole of the maneuvers the defending fleet was completely "up in the air" as to the whereabouts, strength, and intentions of the invader. Had the defending force possessed powerful and swift battle-cruisers, they could have broken through the enemy's scouting line, or at least have engaged it in equal battle, and in all probability the invaders would not have reached our coast without having to accept a line-of-battle engagement.

The programme of the Navy General Board will be a liberal one, and we doubt not that, in view of existing conditions, Congress will be liberal with appropriations. It is our conviction that if the General Board send in a recommendation for battle-cruisers only, so far as armored ships are concerned—four or six of them—they would be fully justified, not only by the events of the war, but also by the general conviction throughout the country.

Inventors Too Cautious

AS a general rule an inventor works in secret, and endeavors in every way to keep from the knowledge of others the invention upon which he is working, and in many cases the only ones who know of what he is doing are members of his immediate family. That is a dangerous course to pursue, and in many cases has resulted in loss to the first and real inventor of his patent rights.

The law requires that a patent shall be issued to the first and original inventor, not to the one who first applies for the patent, and it often happens that, as between two or more applicants for patent for the same invention, the one who last filed has proven to be the first and original inventor, and this may be so even though the first to file has obtained his patent, providing the first and original inventor can offer satisfactory proof showing that he *is* the first and original inventor, and a satisfactory excuse for his delay in filing his application.

When two or more applications are pending in the Patent Office claiming the same invention, or when an application is filed for the same invention covered by a patent within two years after the patent is issued, a proceeding in the Patent Office known as an "Interference" is instituted to determine which of the parties is really the first and original inventor. In such proceedings times are set within which the parties may take testimony and submit proofs to sustain their claim of being the first and original inventor. These proofs cover several points: First, the earliest date on which the party conceived the invention. Second, the earliest date on which he disclosed the invention to others. Third, the earliest date on which he made a drawing of the invention. Fourth, the earliest date on which he made a model of the invention. Fifth, the earliest date on which he made a full-sized and operative device embodying his invention, coupled with evidence to show whether that device was successfully operated.

Concerning the conception of the invention, naturally no evidence can prove a mental conception excepting that mental conception be disclosed to others, so that the disclosure to others of what the inventor is actually seeking to accomplish is the only effective way of proving that at the time of that disclosure, he did in fact have a mental conception.

If the inventor makes a drawing of his invention and puts it away without showing it to anyone, it is utterly impossible for him to prove when he made that drawing, and the earliest date at which the existence of that drawing can be proven, is the date when he showed and explained the drawing to others.

This latter is true also of models and full-sized operative devices. The result is that if the inventor has worked in secret and has kept to himself what he is doing, he has no witnesses to call to his aid when his application becomes involved in an interference proceeding, and having no proof, even though, in fact, he is the first and original inventor, the patent will be issued to his adversary. It is well, therefore, for inventors freely to disclose their ideas to their friends and acquaintances, and this disclosure is best made by means of sketches or drawings, on which the inventor should place his signature and memorandum of the date on which such sketches or drawings were made and shown, and those parties to whom he shows the sketches or drawings and to whom he explains the same should sign the drawings and place thereon the date on which they were shown and explained to them. Preferably this disclosure should be made to disinterested parties, those not connected by blood or marriage with the inventor, and it would be advisable that the disclosure be made to two or more persons in a group or in the presence of each other. It is even advisable to make the disclosure to known rivals working in the same line, providing the disclosure is made under conditions which will enable the fact of such disclosure to be satisfactorily shown should the occasion arise, for if an inventor is prompt in filing his application after he has perfected his invention, he can rest assured that satisfactory proof showing that he is in fact the first and original inventor will prevent his rival, to whom he may have made a disclosure of his invention, from getting any advantage of him by rushing into the Patent Office and filing an application for that which was disclosed to him by the first and original inventor.

When one has conceived an invention, therefore, he should promptly put it upon paper in the form of a sketch or drawing, or make a model embodying the same, and show it freely to others, preserving adequate written memoranda of the date of the making of the drawings and of the disclosure to others. In all cases he should obtain in writing the admission of such disclosure and the signatures of those to whom the disclosure was made, for the most meager and the smallest scrap of written, or, as it is called, "documentary" evidence, is better than volumes of oral testimony based on the mere memory or recollection of the witnesses testifying.

Should this course be followed, there would be less difficulty in interference proceedings in proving the rights of the first inventor, and there would be fewer patents issued to those whose inventive acts are, in fact, subsequent in date, but who offered more satisfactory proof of the date of their inventive acts.

Sometimes patents are issued to one who is not the first and original inventor, but who is prompt in filing his application for patent; for an unexplained and inexcusable delay in filing an application after one has completed his invention is regarded as a strong presumption that he did not make that invention at the time he claimed he had made it; so it is a prime requisite if one hopes to succeed in an interference proceeding to file one's application in the Patent Office promptly after one has completed his invention to his satisfaction.

Healthful Atmospheric Conditions

IT may perhaps be said that a new era in the theory of ventilation dates from the publication, in the Smithsonian Miscellaneous Collections of 1913, of the *memoir* by Prof. Leonard Hill and others entitled "The Influence of the Atmosphere on Our Health and Comfort in Confined and Crowded Places," an abstract of which was published in these columns some time ago. Prof. Hill and his colleagues have, at least, focused attention upon the immense importance of the purely physical phenomena of indoor air—humidity, temperature, and especially air movement—as compared with the effects of atmospheric impurities, whether organic or chemical, in controlling human health and efficiency. Prof. Hill has continued his investigations, and has prepared for the British Local Government Board an admirable "Report on Ventilation and the Effect of Open Air and Wind on the Respiratory Metabolism," which has been published as an official document. Here we have a history of the views that have been entertained in the past as to what constitutes "pure air," and a *résumé* of the conclusions reached in the Smithsonian *memoir*. A considerable amount of space is devoted to the instrumental devices which the author has recently introduced for measuring the rate of cooling, viz., the katathermometer and the calcometer, brief notices of which appeared in the SCIENTIFIC AMERICAN of May 8th, page 431. The author arrives at such results as "that crowded tenements and cities owe their deleterious effects to the withdrawal of the citizens from the adequate action of moving air and sunlight, and not to any chemical impurity of the atmosphere which they breathe"; that "there seems to be no advantage in open-air treatment on cold damp days when the atmosphere is still and saturated with moisture"; and that sanatoria should not be placed in locations so sheltered that the air is apt to be still and moist, nor should suburban houses be blanketed with trees and shrubs.

Science

The Cultivation of Drug Plants in the United States, concerning which there has been considerable agitation since the outbreak of the present war in Europe, is the subject of a Farmers' Bulletin recently issued by the Department of Agriculture. This publication gives, in addition to general instructions regarding cultivation, harvesting and marketing, specific and detailed information concerning about sixty of the leading drug plants which have been grown in this country. The author, Mr. W. W. Stockberger, takes a conservative view of the possibilities offered by this branch of agriculture in this country, and especially deprecates the extravagant claims made in some quarters by persons interested in the sale of plants and seeds, who ask "the public to believe that extraordinary profits may be realized from growing medicinal plants, even in a situation no more promising than the average city backyard."

Metallic X-Ray Tubes.—X-ray tubes emit rays in all directions, so that they must be surrounded by screens of metal, except in the direction in which their action is to be expected. The *Revue des Sciences* quotes from *Elektrotechn sche Zeitschrift*, a description of a metallic X-ray tube which Prof. Zehnder has constructed. The cathode of magnesia covered with tungsten by the Schoop process, is insulated by a large block of porcelain from the metal wall of the tube, which serves as anode and anticathode. The pencil of X-rays escapes through a small window of glass aluminium. Even at the highest vacua this tube, like the Coolidge tube, produces very strong X-rays of any desired hardness. The metal tube is free from the risk of breakage and it is very safe to operate. When it is connected to earth it can be handled freely, and the danger of X-ray burns is almost entirely eliminated.

The Fire-brat.—The common silverfish (*Lepisma saccharina*) is a well-known and troublesome household insect, but its near relative *Thermobia domestica*, known in England as the "fire-brat," is less familiar. In a recent Department of Agriculture bulletin on silverfish Mr. C. L. Marlatt calls attention to the curious habit which the fire-brat has developed of frequenting ovens and fireplaces, where it seemingly revels in an amount of heat that would be fatal to most other insects. The writer say: "It disports itself in numbers about the openings of ranges and over the hot bricks and metal, manifesting a most surprising immunity from the effects of high temperature." It was first described in this country in 1873, and began to be noted commonly about 1895 in Europe. It is of about the same size and general appearance as the silverfish, except for some dusky markings.

Large and Intermediate Ions in the Air.—Novel suggestions as to the nature of certain types of ions in the atmosphere have recently been made by J. A. Pollock in two contributions to the *Philosophical Magazine*. The author considers first the large ions discovered by Langevin in 1905, the mobility of which, at constant atmospheric pressure, depends upon the relative humidity. He states reasons for regarding these ions as collections of water molecules, each surrounding a dust nucleus, and electrified by the attachment of a small ion of the ordinary type. In his second memoir he describes an ion having a mobility intermediate between that of the small ion and the large ion of Langevin. Its mobility depends upon the vapor pressure of the moisture present. Pollock regards the ion of this type as consisting of a rigid nucleus surrounded by a dense atmosphere of water vapor. With increase of vapor pressure a critical stage is reached beyond which the vapor is condensed into water, and the intermediate ion becomes the large ion of Langevin.

Effect of Vitiated Air on Appetite.—It is well known that the researches of such specialists as Dr. Leonard Hill in England and the staff of the New York State Commission on Ventilation in this country, as well as several others, have discredited the old idea that the air of occupied and ill-ventilated rooms becomes "poisonous" through containing the products of respiration, or through any other change in its chemical constitution or its contents. Such ill effects as may be produced by such an atmosphere are ascribed to temperature and humidity only. However, a recent paper by Messrs. C. E. A. Winslow and G. T. Palmer brings to light a hitherto unsuspected effect of vitiated air, evidently due to its chemical rather than its physical qualities. In a series of experiments several persons were kept in a room in which the supply of fresh air, as well as the temperature and humidity, were under control. The effects of ample ventilation and no ventilation, with constant temperature and humidity, were compared. After the subjects had been in the room from two to three hours, a luncheon made up of weighed portions of known calorific value was served and the amount of food left uneaten was weighed to determine the difference in the amount consumed. The general result of the experiments was that the air of an unventilated occupied room contains substances which in some way, and without producing conscious discomfort or detectable physiological symptoms, diminish the appetite for food.

Astronomy

Where Do Comets Come From?—Prof. Elis Strömgren, director of the Copenhagen Observatory, has carried out, with the aid of Mr. J. Braae, an investigation to determine whether comets come originally from interstellar space, as has been commonly supposed, or originate within the solar system. His method of research involves the backward computation of planetary perturbations for eight comets. The conclusion reached is that all comets heretofore observed have originated within the solar system.

Pyrheliometer Standards.—According to a recent publication of the Smithsonian Astrophysical Observatory, nearly all pyrheliometric measurements throughout the world are now made with Angström, Marvin, Michelson, or Smithsonian pyrheliometers, which have frequently been compared with one another and are found to accord within less than 4 per cent, or, in view of recent investigations, perhaps within less than 2 per cent. Smithsonian instruments give the highest readings. Many observers now reduce readings obtained with other instruments to the Smithsonian scale.

A 24-inch Refractor for Ann Arbor.—The astronomical observatory of the University of Michigan at Ann Arbor—called the "Detroit Observatory" in anticipation of the time when the Michigan metropolis shall have spread thirty-six miles west of its present limits—hopes ultimately to possess a 24-inch refractor, thanks to the generosity of Mr. R. P. Lamont, of Chicago. This telescope was ordered in 1911, and the latest report of the Jena glass-makers was that the crown disc had been made, while a mass of flint glass sufficiently large for the flint disc had been produced. The completion of the latter disc would require some months, even under normal conditions, and the war will probably cause further delay. Meanwhile the mounting has made good progress at the observatory shop.

The Astronomische Nachrichten.—This unique and famous astronomical journal has recently reached the end of its two hundredth volume. It was founded at Altona in 1821 by H. C. Schumacher, who edited it until his death in 1850. Since 1872 it has been published at Kiel, to which place the Altona Observatory was moved that year. The present editor is Hermann Kobold. The name of the journal (*Astronomical News*) expresses its character; it is essentially a newspaper for the astronomers of the whole world, and its appeal is to the professional rather than the amateur. Its language is predominatingly German, but it contains frequent notes and articles in other languages—English, French, Italian, Spanish, Latin, etc.

Jeremiah Horrox, or Horrocks, the pioneer English astronomer, is the subject of a biographical sketch by A. D. Watson in the *Journal* of the Royal Astronomical Society of Canada. As Mr. Watson points out, "after a lapse of nearly three hundred years, the world can hardly yet be said to have discovered Horrox; by a vast majority of the people of his own country, his name, which should be a household word. has not even been heard." Yet this remarkable man, who died at the early age of twenty-two, was a genius worthy to be ranked with Copernicus, Kepler, Newton and Galileo. He was the discoverer of universal gravitation, of which Newton subsequently formulated the law; he predicted, almost to the minute, a transit of Venus which Kepler had overlooked, and was the first person to make an accurate observation of such a phenomenon; and he achieved numerous other important scientific results of which the record has been preserved, besides, probably, many which have passed into oblivion, owing to the fact that most of his scientific writings have been lost. Yet during his short life he was hampered by poverty, and he died a poor country curate.

Solar Radiation at Various Altitudes.—"New Evidence on the Intensity of Solar Radiation Outside the Atmosphere" is the title of a recent memoir by Messrs. Abbot, Fowle and Aldrich of the Smithsonian Institution. Besides an extensive review of previous work and a discussion of methods, this publication records the results of pyrheliometric observations made at great altitudes with the aid of sounding-balloons. Two campaigns of this kind have been carried out, in co-operation with the Weather Bureau; viz, in the summers of 1913 and 1914. The writers also record the results of pyrheliometric observations made in a manned balloon, in 1913, by Dr. A. Peppler, of Giessen, Germany. Finally the memoir brings together the results of observations made at various altitudes, from the surface of the earth up to the highest levels reached by sounding balloons, where the atmospheric pressure is reduced to the twenty-fifth part of its value at sea-level. The highest value which Kimball has observed at Washington, D. C., reduced to vertical sun and mean solar distance, is about 1.58 calories. Then we have a series of values, increasing with altitude, including the maxima obtained on Mt. Wilson and Mt. Whitney, Peppler's observations, and finally the sounding balloon results. "Our conclusion," says the writer, "still is that the solar constant of radiation is 1.93 calories per square centimeter per minute."

Automobile

Another New Fuel.—Attention has been called in England to another new motor fuel called "Natalite," for which excellent results and low price are claimed. It is said to be composed mostly of alcohol, and the mixture contains a small quantity of an alkali for the purpose of neutralizing the acidity of the products of combustion of the alcohol, which otherwise would cause corrosion of the valves and cylinders.

Automobile Tops.—One of the first parts of an automobile to show wear is the top. If it holds its shape it fades, and sometimes it both fades and becomes unshapely. It seems the fading could be remedied by a suitable waterproofing dye that would not only renew the color but also restore the waterproof property, impairment of which usually accompanies the change of color. Such a preparation should find a welcome place sooner or later in every garage large or small.

Electric Clock for Automobiles.—Dry cell or storage batteries deteriorate from non-use, as is well known. In order to fulfill the double purpose of preventing such deterioration, and to provide a self-winding clock, one of the large electric clock companies has brought out a novel type of clock for automobile use. The movement is connected to the battery and is wound up at specific intervals by the electric current. Only a very small amount of current is used.

Radiator Water Saves a Life.—Because of the not infrequent occasions on which motoring parties find themselves chilled, as in snow or rainstorms on tours, while insufficiently protected by coats and cloaks, it is of interest to remember that the radiator of an automobile at all times when the car is running has a supply of hot water. Prompt application of hot water recently saved a half-drowned woman at Manhattan Beach, New York, from a severe chill and pneumonia. Doctors declared that the radiator water undoubtedly saved her life.

Automobile Radiator.—A French patent for radiators makes use of a vertical radiator which is placed behind the car hood. Radiator is flush with top and bottom of hood, and consists of sets of vertical air tubes of square section which run through the liquid and from top to bottom. Air enters the top through a suitable open mouth directed toward the front, passes down through the tubes and leaves at the bottom. Circulation is aided by a small fan which is mounted on a horizontal shaft just under the radiator tubes, this fan having the shape of an elongated paddle-wheel. Long traject of the air produces high cooling effect.

Making Tires Last Longer.—Numerous tests have shown that a tire on a front wheel, which is slightly out of alignment, will wear off much faster than it should. In extreme cases it has been found that running a car for less than a hundred miles, with the front wheels improperly aligned, will completely wear down the tread of the best tire. Besides, such misalignment causes the car to steer hard. The best "tire saver" for the average motorist who drives his own car, is to invest in one of the various devices on the market, insuring absolutely proper alignment, both as to height and to divergence from the parallel lines. The price is ridiculously small when compared to the saving in tire expense.

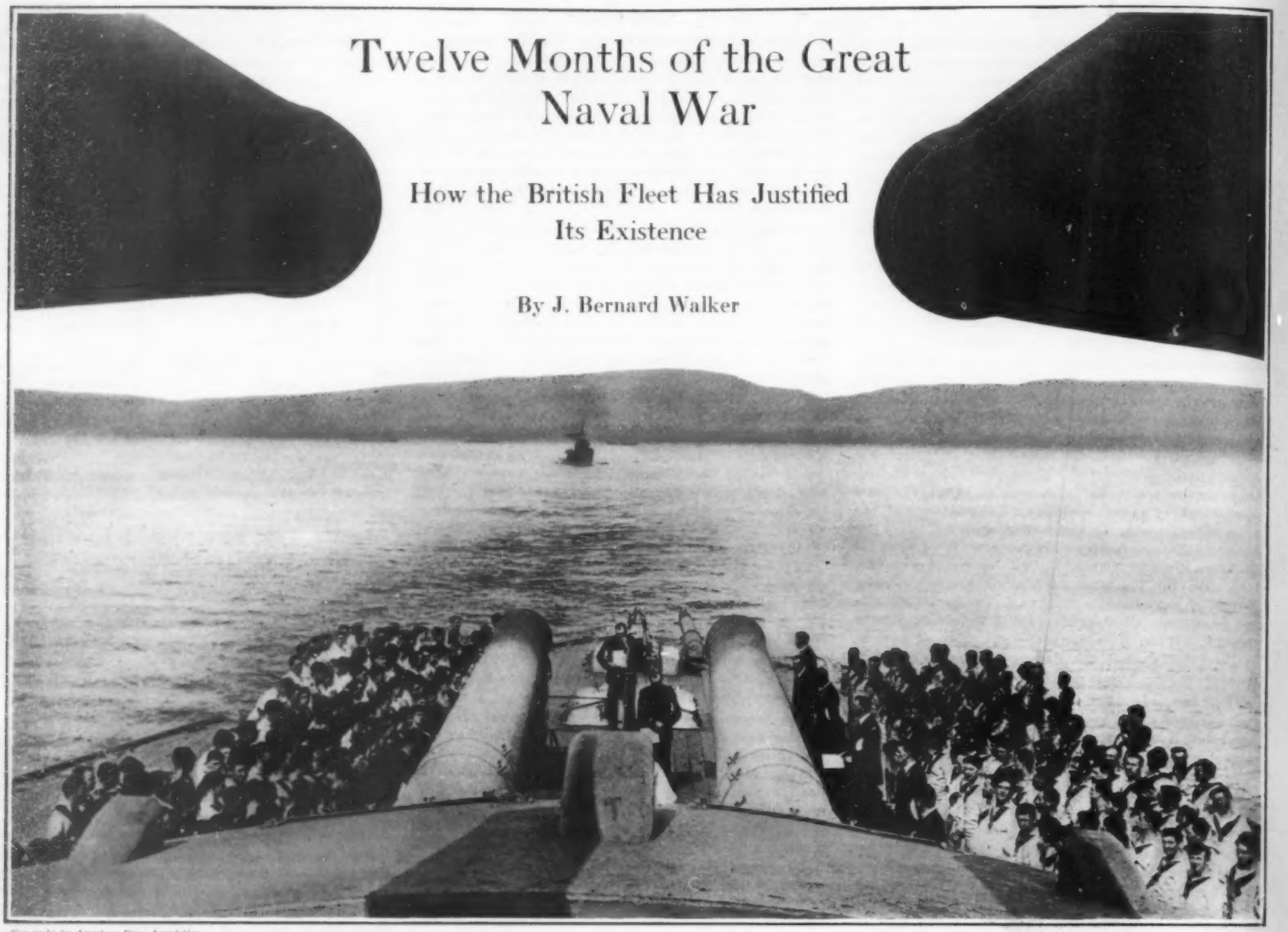
Gasoline from Natural Gas.—The great increase in gasoline consumption has stimulated interest in all means of supplementing the supply, and its condensation from natural gas has not been overlooked, although it has only recently become of commercial importance. Indeed, for this purpose some plants were operated to a limited degree with commercial success in Pennsylvania as early as 1904. The subject had interested inventors many years before, one of the earliest patents relating to the subject issuing in 1866 to Johnson in which is disclosed the art of liquefying the vapors that rise with or are forced up with petroleum. This and other patents are discussed in a bulletin issued by the Bureau of Mines at Washington, which discussed the subject at great length, historically, technically and from the commercial standpoint. It also considers the "doping" or blending of the condensate in order to prepare it for the market, as the liquid first obtained is so volatile that it is quite outside the usually accepted meaning of gasoline.

Joint Owners Held Responsible.—During the past two years traveling salesmen in the middle western and western States have discovered a pleasant and cheap mode of traveling from town to town along their routes, by pooling their funds and investing in an automobile. In most cases the car actually was bought by one of four or five drummers who usually traveled together, the others contributing the running expenses, lunches, etc., to the upkeep. As a result, rather reckless driving at night, and frequent smash-ups on the roads, occurred when the "part-owners" took the steering wheel. The Nebraska Supreme Court decided last month that each and every "contributor" to the upkeep of the car was an "owner" in the eyes of the law and strictly responsible for all damage done by its operation. Speeding at night has since shown a material decrease in the ranks of the knights of the suitcase.

Twelve Months of the Great Naval War

How the British Fleet Has Justified Its Existence

By J. Bernard Walker



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The great guns of the "Queen Elizabeth."

NO attempt will be made in the present review of the first year of the naval war to give a tabulated statement of the losses in ships and men. Until the war is over and authentic officials lists of these losses have been made public, any attempt to give such statistics would be guesswork to such an extent as to vitiate the value of the results arrived at. Thus, if the "Audacious" were destroyed, as rumored, beyond recovery, the loss of that valuable ship alone represented a reduction of fighting strength equal in value to that of all the old battleships sunk in the Dardanelles operations. As a matter of fact, the Admiralty has never acknowledged her loss, and the lay evidence that she was sunk is counterbalanced by other explicit lay testimony, confirmed by much unofficial expert testimony, that she did not sink, but was brought into port, repaired, and is now in commission. The "Agamemnon," a most valuable ship of the semi-dreadnought class, was reported sunk by the Turkish government, whereas later the British government affirmed that she was still afloat. It has been stated that the German battleship "Pommern" was sunk recently in the Baltic by a British submarine; yet the German government, which usually acknowledges its naval losses, has made no mention of any such disaster. And so it goes.

Therefore, the present article will concern itself with the broad aspects of the war on the seas, particularly with respect to the decisive influence which it is exerting upon the final issues of the stupendous struggle upon the land.

Of supreme importance to the allied Teuton nations has been their strong strategical position, due to the fact that both on sea and land they are fighting on interior lines against nations which are geographically separated, and are, therefore, enormously handicapped by the very physical conditions which constitute the main strength of the Teutonic position. How greatly this has affected the land operations is shown in another article elsewhere in this issue, and, so far as the naval situation in home waters is concerned, the geographical situation has been equally favorable, particularly to Germany.

At the outset of the war, the SCIENTIFIC AMERICAN, in reviewing the probable strategy and tactics, drew attention to the fact that no less upon the sea than upon the land was Germany favored by the strategical situation. The allied fleets of England and France possessed, it was true, a superiority, based on total tonnage, of over three to one over those of Germany and Austria, and a superiority in the first fighting line of dreadnoughts of two to one. Although to France was delegated the task of destroying the Austrian fleet in the Adriatic, the English fleet in the North Sea possessed twice as many dreadnoughts as that of Germany, or 31 to 16; of destroyers she had 167 to 130; and of submarines 76 to 21 (the latter total being that estimated on the latest information at that time obtainable by our Navy Department). Under these conditions we stated that it would be hopeless for Germany to accept battle in the open, since ship for ship the English dreadnoughts were more powerfully armed and in seamanship and gunnery they were at least the equal of their opponents. For the reason that the forecast has proved to be so remarkably correct, we quote in full from our issue of September 5th, 1914:

"Hence the Germans have either retired behind the heavy coast fortifications of the North Sea ports and harbors, or, as is more likely, they have taken shelter in the Baltic Sea. The British admiral has orders to seek and destroy the German fleet. But how shall this be done? Wilhelmshaven and the mouth of the Elbe are thoroughly protected by coast fortifications and mines. These consist of heavy, long-range guns and mortars, whose shells would fall with great accuracy over the course which would have to be covered by a fleet which steamed in to a range at which its fire would be effective. The Japanese attack on the inferior Port Arthur defenses proves the futility of a naval attack upon such fortifications as those at Wilhelmshaven, Helgoland, and Cuxhaven.

"Equally disastrous would it be for the English fleet to venture through the narrow entrances to the Baltic; for these are sure to be heavily mined, and in their confined waters the fleet would lose heavily through mines, destroyers, and submarines.

"Another, and most important strategical advantage in the German situation is the Kaiser Wilhelm Canal, which affords quick passage for the largest battleships from the Baltic to the North Sea. This canal practically cuts the British fighting line in half. It was built for this very purpose. For, if the British should force their way into the Baltic, the Germans would pass to the North Sea through the canal and the Elbe, steam into the English Channel, sink the transports that are carrying men and supplies to the English army in France and Belgium, and harry the whole English and French coasts.

"Hence, in seeking to bring the German fleet to action, it would be necessary for England to leave half of her fleet at the mouth of the Elbe, and send the other half around Denmark into the Baltic. This would mean, that so far as her dreadnought strength is concerned, Germany could elect to fight either fleet under equal conditions."

For several years before the opening of the war, Germany, recognizing the overwhelming strength of the British battle line, had paid particular attention to her torpedo service, which, it was believed, had been brought up to a state of efficiency superior to that of the torpedo service in any other navy. In the event of war, it was the plan of the German Admiralty to make a surprise attack, similar to that by the Japanese at Port Arthur, and so weaken the British first line as to enable the German fleet to engage the English under somewhat equal conditions as to numbers and strength. This attack never materialized, probably for the reason that, most fortunately (or perhaps, because of the threatening European situation), the English fleet had been completely mobilized for a grand review. Before demobilization was ordered, the war broke out, and the British fleet, in its full strength, left immediately for the North Sea. The German main fleet bowed to the inevitable and retired to its North Sea and Baltic ports, protecting itself by extensive mine fields, heavy wire netting and other obstructions. And there, except for a few raiding operations against the east coast of England by its fastest ships, it has remained absolutely shut in by the superior strength of the enemy.

For reasons which are still obscure, Germany failed to call home from the Mediterranean two valuable ships, the battle-cruiser "Goeben," and the light cruiser "Breslau," which, after harrying some of the coast towns on the Mediterranean, fled to Constantinople, where they hoisted the Turkish flag and became largely instrumental in bringing Turkey into the war.

And so it came about that in the very first days of the war there was exemplified, on a grand and very dramatic scale, the truth, so long taught by our own Mahan, of the enormous importance of the command of the sea. Not alone was the great German fleet, built up with such high hopes as to its future usefulness on

*COMPLETED SHIPS OF THE CONTENDING NAVIES, AUGUST 1st, 1914.
Including warships of 1,500 tons or more, and torpedo craft of over 50 tons.

RELATIVE STRENGTH OF THE TRIPLE ENTENTE AND DUAL ALLIANCE.

Type of Vessel	Great Britain.		France.		Russia.		Germany.		Austria.		Triple Entente.		Dual Alliance.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Dreadnoughts	31	661,650	4	92,368	..	.....	16	351,519	3	60,030	35	754,018	19	411,549
Pre-dreadnoughts	40	589,385	18	262,675	7	98,750	20	242,800	6	74,613	66	950,810	26	317,413
Coast defense ships	...	.....	1	8,800	2	10,380	2	8,168	6	41,700	3	19,180	8	49,868
Armored cruisers	34	406,800	20	201,724	6	63,500	9	94,245	2	13,380	60	672,024	11	107,625
Cruisers	74	382,815	9	46,095	9	52,845	41	150,747	5	13,815	92	481,755	46	164,562
Destroyers	167	125,850	84	35,812	91	36,748	130	67,094	18	9,450	342	198,410	148	76,544
Torpedo boats	49	11,488	135	13,426	14	2,132	...	.....	39	6,852	198	27,046	39	6,852
Submarines	75	30,362	64	27,940	30	6,506	21	14,140	6	1,686	169	64,808	27	15,826
Total tons completed		2,208,350		688,840		270,861		928,713		221,526		3,168,051		1,150,239

* Because of conflicting official reports, no attempt is made to give a list of the naval losses of the war.

Tables showing relative strength of Triple Entente and Dual Alliance.

the high seas and costing over one and one half billion dollars, driven from the high seas and shut up within its own restricted waters, but Great Britain was rendered absolutely secure against invasion, and the British seas were so completely freed of the enemy that her transports began to run (and have continued to run for a whole year) to and fro between English shores and the Continent, conveying hundreds of thousands of men and their supplies for service against the land armies of Germany. Furthermore, both Great Britain and France have transported troops to the European battlefields from every quarter of the habitable globe.

The same controlling influence of sea power has been witnessed during the year within the Baltic, where the predominance of German naval strength has enabled the dual alliance to maintain an ever-growing traffic between the neutral states of Norway and Sweden, and her own Baltic powers. The Russian navy, greatly inferior in strength, has done what it could and has done it well, the honors of the naval warfare, so far as ships lost is concerned, being fairly well divided between the two navies; unless indeed it be true that the German battleship "Pommern" was lately torpedoed, a fact which the German Admiralty has denied.

Equally dramatic and scarcely less formidable in its effect upon the ultimate issues of the great war was the manner in which, within a few months, the British and French sea power had swept the German merchant marine from the high seas. At the opening of the war, Germany possessed over 5,000,000 tons of shipping, and her far-extended foreign trade was one of the most notable among her many industrial and commercial successes. Such was the predominance of the allied fleet on the high seas, however, that, once war was declared, not a merchant ship left either German or foreign ports, and those that were on the high seas made haste to intern themselves in the nearest harbor of refuge.

And just here is the fitting place to pay tribute to the great skill and daring with which the German cruisers and armed liners carried on their depredations against allied commerce during the first few months of the war—an enterprise in which they were greatly aided by that elaborate system of secret service with which the Germans for many years past have completely networked the world. It is necessary here only to refer to such exploits as those of the "Emden," "Karlsruhe," "Dresden," and others, to show what a few fast ships in the hands of able seamen and officers can do in working havoc among the enemy's shipping on the high seas.

It is impossible within the limits of this review to enter into any detailed analysis of such engagements as have occurred during the twelve months of the war. The first of these took place on August 28th, 1914, in the Bight of Helgoland, when British destroyer flotillas, headed by two light cruisers, were sent in to endeavor to draw the Germans out to an engagement. The challenge was answered, and for several hours there was a very spirited fight, during which, including both sides, between fifty and sixty high-speed vessels were engaged. The expedition was under the command of Admiral Beatty, in the battle-cruiser "Lion," and when the British contingent failed to reappear, the "Lion" dashed in and saved the situation by sinking three of the German light cruisers and a couple of destroyers with her salvos. The British fleet drew off with its light cruisers rather badly mauled, but without the loss of any ships.

A most significant fact in this engagement was the difficulty of securing hits with the torpedoes. It is estimated that fully fifty ships were using the torpedo freely; yet, so far as is known, not a single hit was scored through several hours of engagement. The high speed and quick maneuvering power of the ships attacked, and the difficulty of estimating the speed of the enemy vessels, seem to have contributed to render torpedo fire so extremely uncertain at the distant ranges, as to make it almost negligible.

Thus far, the most important naval fight of the war was that between the British and German battle-cruisers, which occurred in the North Sea, when the British intercepted the Germans on their second attempted raid of the seacoast towns of England. It was a running fight, in which three German 29-knot battle-cruisers and the 26-knot armored cruiser "Bluecher" were engaged by three 29-knot British battle-cruisers and two battle-cruisers of 26 knots. Each side was assisted by some light cruisers and several flotillas of destroyers. The "Bluecher" was abandoned by her consorts and fell a victim to the gunfire of the 26-knot battle-cruisers. The "Seydlitz," "Doerflinger," and "Moltke" were pursued by the "Lion," "Princess Royal" and "Tiger" in a running fight, during which the British flagship was put out of action by a shell in the engine room, and the German battle-cruisers were heavily punished by gun-fire, fires breaking out on two of the ships. They escaped by leading the pursuing British ships into a group of submarines, when they turned and abandoned the pursuit.

A striking feature of this engagement was the great range at which the British landed, namely, 17,000 yards, or ten miles. Spotting from the fire-control platform was impossible at this range, but the work was done by the British destroyers, which steamed abreast of the Germans and reported the fall of the shots, by wireless, to their own ships. How heavily the Germans were punished is not known, but in the intervening months since that fight they have attempted no more raids against the English coast.

In the Pacific Ocean and South Atlantic two notable engagements served to emphasize the fearfully destructive character of modern naval warfare. The first of these occurred off the coast of Chile, between a squadron under von Spee, composed of the armored cruisers "Scharnhorst" and "Gneisenau" and the light cruisers "Nurnberg," "Leipzig" and "Bremen," and a squadron under Admiral Craddock, consisting of the armored cruisers "Good Hope" and "Monmouth" and the light cruiser "Glasgow." The German armored cruisers were the crack gunnery ships in the German fleet, and both were manned by long-service men. The fight resulted in a crushing defeat for the British, the "Good Hope" and "Monmouth" being early set on fire by the accurate salvos of the German armored cruisers, which are reported to have opened at a range of 12,000 yards. The "Good Hope" and "Monmouth" were sunk; but the "Glasgow" escaped to do good service a few weeks later in the battle off the Falkland Islands.

The British Admiralty, resolving to take no chances with these formidable German ships, dispatched the battle-cruisers "Invincible" and "Inflexible" and the armored and light cruisers, "Glasgow," "Kent," "Carnarvon," "Cornwall," and "Bristol" to round up and sink von Spee's fleet. The British were coaling up at Port Stanley, Falkland Islands, when the German fleet, consisting of the "Scharnhorst" and "Gneisenau," and the light cruisers "Dresden," "Leipsig" and "Nurnberg" were sighted. It was a running fight. The "Inflexible," "Invincible" and armored cruiser "Carnarvon," pursuing the "Scharnhorst" and "Gneisenau," the rest of the British fleet making after the German light cruisers. After a running fight lasting several hours, all of the Germans ships except the "Dresden" were sunk by gunfire. In this fight it was again demonstrated that effective work with modern heavy guns can be done at ranges of from fifteen to twenty thousand yards, at which distances both the German and English ships landed heavily upon each other. The result with British 12-inch guns pitted against German 8.2-inch guns was a foregone conclusion, although according to the British officers the Germans did some "magnificent shooting."

In the several duels which have occurred between individual ships, the protected cruiser "Highflyer" sank the armed liner "Kaiser Wilhelm der Grosse" off the west coast of Africa; the armed liner "Carmania" sank the armed liner "Cap Trafalgar" in the West Indies, and the Australian light cruiser "Sydney," after a running fight, demolished the light cruiser "Emden" and drove her ashore.

Now in all these sea fights, whether between fleets or individual ships, it has been demonstrated very forcefully that a combination of heavy gunfire with high speed is likely to prove the controlling factor in determining victory or defeat. The ship with the heavy guns, as in the case of the Falkland Islands fight, and of that between the "Sydney" and the "Emden," is able to choose the distance most favorable to her own batteries and least favorable to the enemy, and the result in every case has proved fatal to the slower and less heavily gunned ship.

Germany, realizing that her naval ships were shut up securely in her own ports, and that her merchant fleet being swept from the high seas, she was cut off from the greater part of her supplies by sea, had but one form of warfare left open for herself, namely, the secret warfare by mine and submarine. With a free hand she not only strewed her own waters with mines, but scattered them liberally along the highways of commerce. Because of this, and no doubt largely because the danger from submarines rendered it impossible to maintain a close blockade of German ports, Great Britain declared the North Sea closed, and established her lines of blockade from Calais to Dover and between Scotland and Norway. The losses due to German mines were heavy in the early months of the war, both to belligerent and neutral nations, though of late the casualties from this cause have been relatively few.

It is with the submarine that Germany has scored her greatest success, and in this class of warfare she has certainly done remarkably well. Her earliest success was the sinking by submarine of the "Aboukir," "Cressy" and "Hogue," a disaster which is to be blamed as much to British carelessness as to German skill; for the ships were steaming at only 7 knots speed, and were unattended by destroyers. Later, the Germans scored against the battleship "Formidable," sinking her as she was on her way to Plymouth down the English Channel, and, by mine or submarine, against the "Audacious." If we except a small cruiser, the "Niger," sunk at Dover, and two destroyers, this constitutes the principal German successes against naval ships; for it is a fact that for several months, at least around

(Concluded on page 127.)

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An Austrian 24-centimeter (9.6 inches) howitzer.

The First Year of the Great War

A Review of the Operations in All Theaters of War

By Capt. Matthew E. Hanna, Recently of the General Staff, U. S. A.

ON June 28th, 1914, the world heard of the assassination by a Serb in Sarajevo of the Archduke Francis Ferdinand, heir to the Austrian throne. Who could have foreseen at that time the terrible deluge of blood and iron that was to sweep over Europe as a consequence of this act. Nearly a month passed before Austria sent an ultimatum to Servia on July 23rd, giving her but a few hours in which to frame her reply. The Servian answer failed to satisfy Austria, and one month to a day after the assassination she declared war on Servia. During this brief period the situation grew in gravity until it became a crisis of greater magnitude than any which had confronted Europe since the days of Napoleon. Soon all Europe was to act as though possessed of an evil spirit of madness and destruction.

What will Russia and Germany do? was the question heard on all sides. Russia, the self-appointed guardian of Servian sovereignty, was bound to protest against Austria's action, and Germany was equally bound to support her Austrian ally should Russia be drawn into the fray. With Germany and Austria pitted against Russia (and little Servia) there would be slight hope of preventing the conflagration from spreading to France and Great Britain which with Russia formed the Triple Entente. Germany and Austria would then be in a fair position to induce Italy, their ally in the Triple Alliance, to join in their struggle. As the war progressed, minor European states might find it difficult or impossible to remain neutral. Far away Japan was allied to England in a way that would permit her to enter the conflict should her interests seem to demand this. European colonies in Africa would certainly become involved. From Australia and Canada armies would be drawn to serve under the British flag. The world stood on the threshold of the greatest war of all times.

Photograph by Branger

General Joffre, commander-in-chief of the French armies.

Russia the First to Mobilize.

Russia promptly answered Austria's ultimatum to Servia by ordering the mobilization of her army. This was Germany's cue to come from behind the scenes, for Russia must not be permitted to secure the great advantage that would result from mobilizing her army before a declaration of war. Germany estimated that her ability to effect a speedy mobilization would more than offset the greater numbers of Russia, and all her plans for beginning a campaign against the Russian-French-British coalition were based on this assumption. It was not strange, then, that the Russian mobilization order brought an immediate protest from Germany in the form of a demand that mobilization cease. As was to be expected, Russia rejected this demand, and Germany replied by a declaration of war on August 1. But four days had elapsed since Austria had declared war on Servia, yet in that brief time three great nations, Russia, Germany, and France, had been seized by the frenzy of madness and drawn into the vortex of war. Great Britain was last to join in the struggle, but the violation of Belgium's neutrality by Germany a few days later furnished her with an acceptable reason for casting her lot with the Allies. Once more was the map of Europe rolled up to collect dust until some future date when with the dawn of peace and reason it could be opened up and revised.

In all the contending powers the mobilization machinery was at once put in operation, and as was to be expected, the German machine ran smoothest of all, and the Russian machine was slowest; also, as was well known, Germany proposed to make the most of this by a drive into France that would revive memories of Metz and Sedan before Russia could dangerously menace her eastern frontier. She had twenty-five army corps, and it was believed that she would mobilize at least twenty-three of these on the French frontier and send but two to her Russian border. To meet this German invasion the French had twenty-one corps, but one was in Africa and two must be kept on the Italian frontier until Italy had declared her intentions. This left France but eighteen corps with which to face the first grand drive of the German twenty-three corps. To offset her weakness, she had the line of wonderful fortresses stretching across her eastern frontier from Luxemburg to Switzerland, effectually barring the only front entrance from Germany to France, she had the prospect of support from England's available army of one hundred and fifty thousand men, and as later events were to prove, she had the powerful assistance of the heroic little Belgian army.

How Germany and Austria Co-operated.

In the eastern theater the Austrian army of sixteen

Field-Marshal von Hindenburg, the most conspicuous general on the German side.

corps had to be divided between the Servian and Russian fronts, with probably ten to twelve corps against Russia and the remainder against Servia. On both fronts she was weaker than her opponent. The Servian army, with an unblemished record in the Balkan wars to give it prestige, numbered about 300,000 men, and against it Austria had not more than 250,000. The Russian hosts opposed to her consisted of twenty corps, or more than a million men, located in European Russia, and to meet this vast horde Austria had less than five hundred thousand men. With this comparatively weak army her task was to wage a successful offensive campaign against Servia, while conducting an active defensive campaign against Russia that would hold the Russian army in check until Germany had disposed of France. Austria undertook her part of the combined Teuton task with enthusiasm and determination no less than that of Germany, but the events of the first few months of the war were to show that she was outmatched in both numbers and skill. From the day Austria declared war on Servia to the present time there has been the closest co-operation between the two great Teuton nations. Their initial plan of campaign had been arranged in advance by the two great general staffs. It resulted naturally from the location and strength of the powers forming the Triple Entente. Russia on the east was completely debarred by Germany and Austria from all land communication with her allies, France and Great Britain, on the west. So outnumbered were the Teutons by the coalition against them, that their only reasonable chance for decisive success lay in their concentrating in overwhelming force against the enemy on one front at a time, while holding the enemy on the other front as best they could. For one year they have played this simple game of strategy, if not always with complete success, certainly with a larger element of success than the observance of any other central idea could have given them. Their position side by side square between their foes, combined with the admirable system of strategic railways in the two countries, has made it possible for them to shift their armies with astonishing celerity from one frontier to the other, and has enabled them consistently to adhere to the central controlling idea of their strategy.

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East Galicia has been devastated by the Russians as they retreated. This shows all that is left of a Galician village.

Violation of Belgian Neutrality—A Military Necessity.

Coincident with her declaration of war on Russia, Germany began her mobilization on August 1st. The principal mobilization was effected along the Rhine, the line from which all German western operations had their origin. Although the mobilization probably was not completed until about August 10th, the more advanced frontier troops crossed the western boundary before that date. From the Rhine the vast army advanced along three routes, one to the north through Belgium, one in the center through Luxemburg, and one to the south through Alsace and Lorraine. If the neutrality of Luxemburg and Belgium was not to be violated, the entire army of a million men must enter France by the narrow gateway between Luxemburg and Switzerland, and this had been closed in the years since the calamity of 1870 by a line of fortresses as nearly impregnable as land defenses can be made. So formidable was this barrier that Germany chose to violate the neutrality of Belgium, thereby deliberately inviting the wrath of the world and furnishing England with the pretext she was seeking to justify her entering the struggle.

By August 4th her advance troops had crossed the Belgian frontier, and on that day three divisions attacked Liége. Belgium had refused Germany's request for permission to cross her territory, and had declared her intention to oppose the German advance. At Liége she began the series of hopeless struggles against tremendous odds, a sublime effort to maintain her national honor, which have won for her an eternal place in the annals of warfare. Instead of marching unopposed through Belgium, the German army met such stubborn opposition from the Belgians that French soil was not reached until the beginning of the fourth week in August. It had taken this army three weeks to cover the hundred miles of its route across Belgium, and later events revealed the tremendous influence this delay had on the final outcome of the first German drive at Paris.

After three days' bombardment by the huge German howitzers, Liége was entered on August 7th, and the German army pushed on toward Brussels. At Louvain it again met the Belgians in force, defeated them here on August 19th and entered Brussels the next day. The defeated Belgians fell back to the north on Antwerp, and the Germans pushed on into France. Farther south Namur fell on August 22nd, opening the way to Charleroi, where the French were defeated August 23rd, the same day that the British were driven from Mons by the Germans who had passed through Brussels. At last the Germans could leave Belgium behind them and begin the long delayed invasion of France.

France in the Early Days of the War.

In the meantime the French had completed their mobilization and had put in operation the plan of their general staff for the opening of a campaign against Germany. They were not disposed to permit Germany without a serious struggle to assume the initiative in the opening weeks of the war and carry the fighting into French territory. On the contrary, they planned to take the offensive in great strength at the earliest possible date after the declaration of war, push across the frontier into Germany and compel the Germans to play to their lead. Shortly before the middle of August they were ready for this move, and began their advance along three lines. The northernmost army moved toward the Belgian frontier, the central army advanced to the east from Verdun, and the southernmost army pushed into Alsace and Lorraine. Thus it happened that while the great driving force of the German army was fighting its way through Belgium, the bulk of the French army was moving by it to the south in an endeavor to force its way into the lost provinces of Alsace and Lorraine, and so interfere with the systematic development of the German plans that the German forces in Belgium would be weakened by drafts to support their weaker armies in the south. Similarly the German advance through Belgium was calculated to relieve French pressure in Alsace and Lorraine.

For some days this struggle went on to determine whether the initiative should remain with the Germans in the north or the French to the south, but while Germany was sweeping everything before her in Belgium, France was suffering one reverse after another along her entire front, except in Alsace and Lorraine, where her offensive was partially successful. The French central army was turned back in the Ardennes, was defeated roundly at Neufchateau and finally terminated its part of the disastrous attempt at a counter offensive by retreating to the line of French fortifications in the region of Verdun. The southern army found Alsace and Lorraine weakly defended and succeeded in occupying Saarburg and Muelhausen. But by this time the German southern army had come up in sufficient force to check the invasion, and a few days later this French force was driven back to its fortified barrier near Nancy. In the meantime the northern army with Belgian and British aid had been struggling desperately, but vainly, to check the advance of the overwhelming German force in Belgium.

The Germans had won in this opening struggle for the initiative, and for the next few weeks France was compelled to bow to the German will. She immediately began to shift her forces from her right wing on the south to her left wing in front of the Germans coming through Belgium, leaving the defense of her eastern frontier to reduced garrisons in the barrier fortresses. The strategic position of Germany at this time was excellent. Along her entire front her troops had been victorious, Belgian resistance had been overcome, she was within one hundred and fifty miles of Paris, with the weakest fraction of the French army in her front. The world in the future might make her pay dearly for her disregard of what she chose to call a "scrap of paper," but for the present she could be depended on to lose none of the advantages gained by her violation of Belgian neutrality.

Photograph by Stranger

In the wake of the Germans. Whole French villages have been reduced to crumbling ruins.

The German War Machine Rolls On.

With all the precision and energy of a smooth running powerful machine she began her memorable advance from the Belgian frontier which was not to be stopped until the very gates of Paris were reached. Like a huge gate hinged on the fortress of Verdun, her long line swung through northern France to close the

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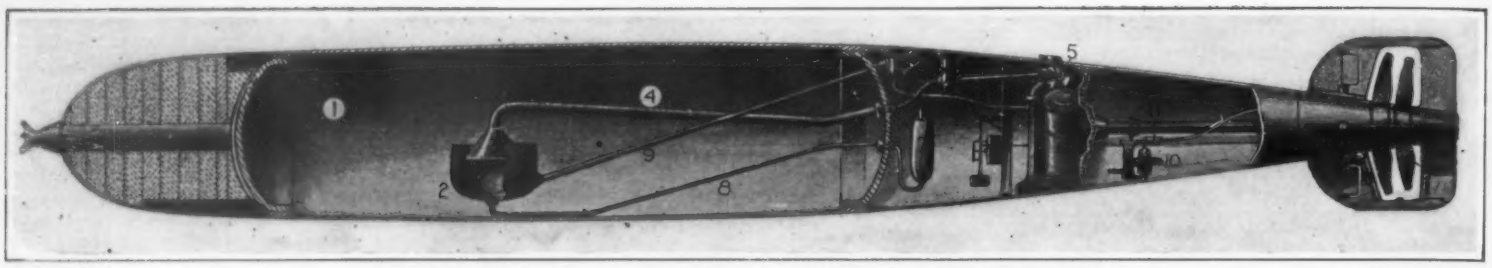


Fig. 1.—The old style torpedo with internal superheater and Brotherhood engine.

The Modern Automobile Torpedo

How It Is Constructed, How It Works and How It May Be Improved

By Edward F. Chandler, M.E.

WHEN the torpedo was first recognized as a weapon of war, its effective range was a little over a quarter of a mile. It was essential to get close enough to an enemy to use it. Hence, the light high-speed torpedo boat was developed. The boats were to be used either singly or in groups—singly at night or when the opportunity was favorable and in groups when it was impossible to escape detection, and several boats would have to be sacrificed in the hope of enabling one, at least, to plant its torpedo in the side of a warship. Then came the torpedo boat destroyer—a vessel fast enough to overhaul and destroy the torpedo boat and thus rid the big ships of a possible enemy. Since the torpedo boat destroyer, in addition to rapid fire rifles, itself carried torpedoes, since it was, if anything, even faster and more seaworthy than the torpedo boat, it was obvious that the torpedo boat could be dispensed with, and so torpedo boats, in the old sense of the term, are no longer built. But even the torpedo boat destroyer never brought out the full possibilities of the torpedo. It was the submarine that really opened up the field for torpedo attack, simply because of its ability to make its way within easy range without exposing itself to gun-fire.

The capital ships of the world's navies are equipped for firing torpedoes as well as torpedo boat destroyers. But so deadly are the guns of a battleship at great distances that actions are now fought far beyond effective torpedo range. Hence the development of naval architecture has brought with it a development of the torpedo—a development which has had for its object an increase of speed and range.

The tactical possibilities of the submarine have led to the development of a torpedo especially adapted for submarine use—a short range weapon carrying a charge of explosive 30 to 50 per cent heavier than that which fills the warhead of the standard torpedo. This end has been attained by employing weight and space previously given up to the propelling medium not needed when operating at such short ranges as 300 or 600 yards at which a submarine strikes.

The torpedo is by far the most expensive and complicated piece of mechanism used in naval warfare. Its design and construction have taxed the ingenuity of the most ingenious minds. Consider what is demanded of this formidable weapon: It must travel at railroad speed beneath the water; therefore, it must have a powerful engine plant. It must never swerve from a predetermined course; therefore, it must have a mechanism to keep it from plunging too far beneath the surface, and from departing too far from a vertical plane. It must carry an explosive charge of sufficient power and size to inflict serious injury; therefore, it must have a large explosive-carrying capacity. It is a little high-powered ship, carrying destruction in its warhead—a little ship which runs itself and guides itself, as if it had a human engine crew and a human pilot.

The author of this article is intimately familiar with the designing and building of torpedoes used in the United States and foreign navies, and is responsible for numerous improvements. The electrical gyroscope and depth gear, of which he is the pioneer in this country, bids fair to become one of the most important steps tending to increase the efficiency of torpedo fire control yet inaugurated.

The following article from his pen is probably the most complete disclosure of the automobile torpedoe's construction which has appeared in an American periodical.—EDITOR.

The earliest torpedo was merely a tapered wooden spar, capped with an explosive head and capable of being projected over short distances. It soon gave way to a shell containing a propelling system. But in spite of its increased speed, in spite of its superiority to the tapered wooden spar, this form of torpedo was far too erratic, even though brought to a comparatively high state of mechanical perfection. It could be employed with safety only under ideal conditions, and then only for a range of about 500 yards. It was a submarine projectile, depending for accuracy upon delicate adjustments, determined by trial; and even with these adjustments, the weapon could not be relied upon to follow a straight course, since it would be disturbed by many external influences as well as by its own rolling.

It was the introduction of the gyroscope that gave us the modern automobile torpedo; for by means of the gyroscope it was possible to cause the steering gear to bring the swerving torpedo back to its course. Not only that, but the effective range was more than doubled.

This early torpedo was driven by compressed air. Its essential features are revealed in Fig. 1. The compressed air was stored at about 2,000 pounds per square inch in an air flask, Fig. 1, forming part of the torpedo body. From this flask the air was conveyed through a reducing valve and thus supplied at a uniform working pressure of about 200 pounds per square inch to a small reciprocating engine.

In order to increase the range of the weapon, superheating of the air was resorted to. The old style of internal superheater is disclosed in Fig. 1. Within the air flask 1 was a copper superheater bowl 2, with a spider on top, carrying a funnel-shaped outlet 3. The main air supply pipe 4 was connected with this outlet 3, and was carried as far as the reducing valve 5, necessary to feed the air gradually at a predetermined pressure to a three-cylinder Brotherhood engine. The air was superheated by means of an alcohol flame. Fuel was drawn from a flask 7 and supplied by a feed pipe 8 to the superheater bowl 2. The alcohol was ignited by means of the tube 9, at the top of which was a cartridge. As the torpedo was launched and a latch pulled, the cartridge was detonated so that a flame was projected through the tube to the bowl 2, in order to ignite the fuel. Freezing had always been a serious drawback when cold compressed air was used. This superheating system eliminated that difficulty. The old gyro gear is shown at 10. It controlled the valves of a steering engine 11.

Contrast with this early type of weapon the improved mechanism shown in Fig. 2, and it becomes apparent how remarkable have been the strides in the development of the torpedo. When F. M. Leavitt introduced the balanced turbine and the external superheater, the efficiency of the torpedo was greatly increased. The range was gradually extended and the speed increased until it was possible to dispatch the weapon over its course of 5,000 yards at a velocity of nearly 36 knots. From the air flask 1 a pipe 2 leads to the reducing valve group 3, connected with the superheater flask 4. Fuel is conveyed to this superheater flask from the alcohol flask 5. Within the flask 4 is an ignition device, more or less similar to that which has been described in connection with Fig. 1. A pipe 6 leads from the lower end of the flask 4 to the nozzle 7, by means of which nozzle superheated compressed air is projected against the blades of a turbine 8, of which 9 is the rotor and 10 the stator. The turbine runs at about 10,000 revolutions per minute, and its shaft 11 at about 1,500. Hence, an intermediate reducing gear 12 and 13 is necessary. The turbine exhausts directly into the after body shell 14, through the funnel 15, through the hollow shaft 16, and thence through the tail of the torpedo. A spider 17 connects the funnel 15 and its attached hollow shaft 16 with the solid shaft 11. Within the funnel-shaped body 15 is a valve against which a spring presses lightly. It is the object of this valve to prevent the entrance of sea water, the adjustment of the spring being such that the exhaust gases may readily escape. The propellers 18 must be revolved in opposite directions. This is accomplished by the bevel reversing gearing 19.

The torpedo is steered in a horizontal course by the vertical rudders 20. These rudders are connected by a semi-circular ring 21, attached to the rudder rod 22, operated by the gyro-steering gear 23.

In order to prevent the torpedo from diving or from rising an automatic depth gear is installed. As shown in Fig. 3, the depth gear rudders 26 (one at each side), are connected with a rudder rod 24, leading to a servo motor 27. A pipe 28 supplies this servo motor with air at about 400 pounds per square inch pressure. Within this servo motor is a balanced piston valve 29, which can be operated with very feeble power. Exposed to the sea is a hydrostatic diaphragm 30, connected with which is a threaded stem 31, upon which is located a nut 32. Against this nut one end of a spring 33 passes, the other end of the spring being seated in the top of the diaphragm chamber 34. The stem 31 extends through the diaphragm, and terminates in a square-head 35, packed so that water may not leak into the

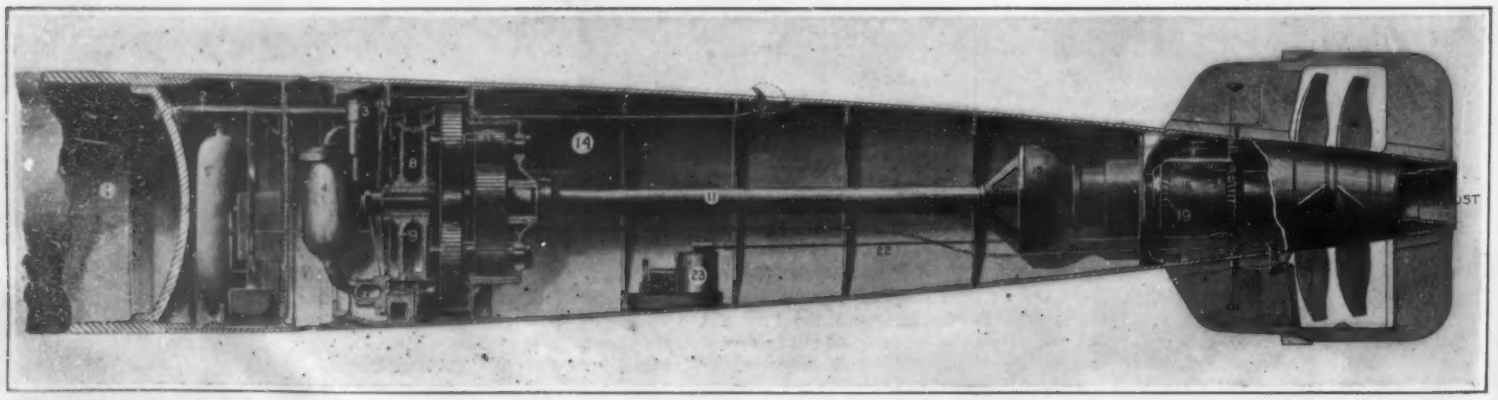


Fig. 2.—Detail of superheater, balanced turbine and reducing gear.

chamber 34. In order to turn the stem and move the nut 32 up or down a key is used which is applied to the square head 35. Thus the spring pressure on the diaphragm 30 can be increased or decreased. The compression of the spring may be regulated by means of an index carried on the squarehead 35 so that the spring may be adjusted to the depth at which the torpedo is to travel. The diaphragm 30 also carries a trunnion bearing 36, which engages a lever 37, keyed to a shaft 38, which runs through a stuffing box, to prevent the entrance of sea water. Within the torpedo is a lever 39. Movement of the diaphragm 30 sets up a corresponding movement of the lever 39. Fulcrumed at 40 is a lever 41, the upper end of which is connected by a rod with the piston valve 29, and at its lower end with the rod 43, leading to the pendulum 44. The connection with the pendulum is not rigid, but yielding as shown. The rod 43 passes through an eye 45 on the pendulum rod. Around the end of the rod 43 two springs 45 are coiled in opposite directions and are held between the adjustable nuts 46. This arrangement is such that the pendulum does not immediately transmit motion to the rod 43, but stores up energy in the springs until the pendulum has moved through a distance of about three degrees. At this point the stored energy in the spring is sufficient to move the rod. The pendulum is suspended from a bracket 47, attached to some convenient part of the torpedo.

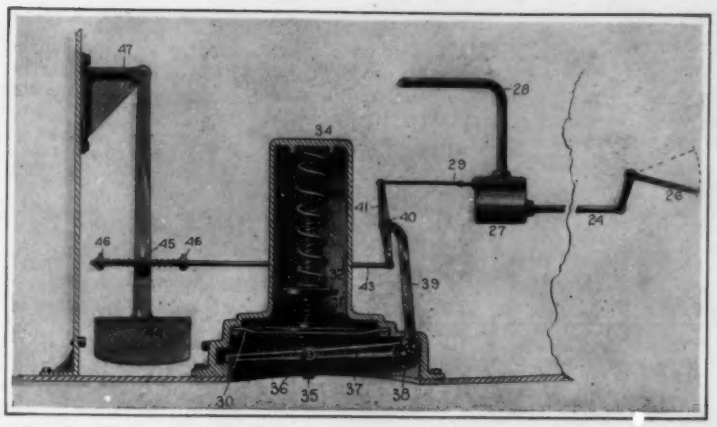


Fig. 3.—The mechanism whereby the depth of the torpedo is automatically controlled.

Assuming that the stem 31 has been properly adjusted and assuming that the torpedo has been launched, what is the operation when the depth rudders swing from their correct position? The pressure of the sea water against the diaphragm 30 and the pressure of the spring 33 counter-balance each other. If this counter-balance is disturbed, the rudder 26 must inevitably be operated. In Fig. 3 the rudder 26 is in the down steering position. As the torpedo proceeds in its downward course, the pressure of the water overcomes the spring 33 with the result that the piston valve 29 is pushed in and the rudder 26 is moved upward.

The pendulum 44 is employed to modify the diving effect which would take place if only the hydrostatic diaphragm were depended upon. The effective strokes of the hydrostatic diaphragm and pendulum are so proportioned that one tends to neutralize the other. If, in passing from above to below a set depth, the torpedo dives at an angle of more than let us say, three degrees, the pendulum swings over and gives the rudder a slight upward tilt or the reverse as the case may require. Hence the torpedo travels in a somewhat sinuous, though on the whole, substantially straight course, at a mean distance below the surface, closely approximating the set depth. The operation of this combined apparatus is fairly satisfactory, especially with respect to the hydrostat. The pendulum, on the other hand, is open to certain criticism. For example, it is heavy and it has a tendency to lag as the speed is accelerated.

As the basis of a clear understanding of the automobile gyroscopic steering gear employed in the torpedo to prevent the weapon from swerving to either side of its given course, we must regard the gyroscope as the compass of the torpedo as well as its pilot. Assuming that we desire to proceed due north, and knowing that the compass needle, to use the popular expression, "points toward the north," it is clearly necessary while navigating the vessel to make sure that the compass itself does not deviate—in other words, that we do not run off the course. The compass is our guide, and by manipulating the helm we are enabled to steer the vessel over virtually a straight course. The gyroscope is in essence a rapidly rotating flywheel. It is a property of such a body to resist all efforts to change its plane of rotation.

The gyroscope consists of a small heavy flywheel mounted so as to be freely revolved in a frame which is in turn pivoted in a gimbal ring. The wheel, thus mounted, is free to swing around, both in a horizontal and a vertical plane. A locking device is provided which holds the flywheel carrying the frame, and consequently the wheel itself in a fore and aft position in the torpedo during the operation of spinning the gyroscope. While thus held, the wheel is revolved at high speed. When released it will retain its plane of rotation, and even though the torpedo may be swung around horizontally, the gyroscope will remain substantially in a fixed plane so long as it continues spinning at a sufficiently high velocity.

Except that the gyroscope does not necessarily take up a north-and-south position, but retains any position impressed upon it, it acts as the compass of the torpedo. The torpedo with the gyroscope locked in a fixed relation to the axis of the weapon is placed in the launching tube. When the launching tube has been pointed toward the enemy and discharged, the gyroscope, which has been simultaneously spun and unlocked, retains the original direction of rotation impressed upon it at the moment the weapon is released. When the torpedo is on its way the gyroscope serves the double purpose of compass and steersman. Automatically it operates the helm to steer the vessel over a substantially straight course.

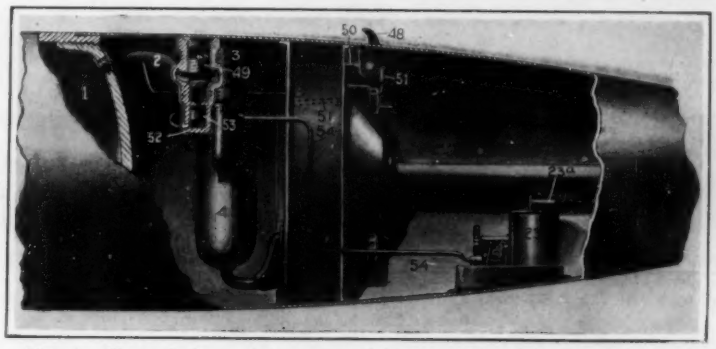


Fig. 4.—The reducing valve group and its connection with the gyroscope.

In Fig. 4, the starting latch and gyroscope spinning mechanism of a standard type of torpedo are illustrated. The figure is a detail of the torpedo shown in Fig. 2, 1 indicating against the air flask and 4 the superheater, and 3 the reducing valve group. The starting latch 48 on the torpedo is engaged by a pawl, located in the torpedo tube, and is consequently pulled or shifted over as the torpedo is ejected. As a result high-pressure air from the flask 1 is conveyed by means of the pipe 2 to the stop-valve 49. Air at high pressure simultaneously flows through the small tube 50. When the latch 48 is thrown, the air in the pipe 50 may pass through the pipe 51 to the chamber 52, for the purpose of pushing up the stop valve 49. This permits the air to flow freely through the reducing valve, forming part of the valve group, and through the superheater as previously described. It will strike the reader that air pressure from the same source of supply is caused both to open a valve and to hold it closed. This paradoxical feat is accomplished by giving the valve surfaces different diameters. It will be noted that valve 49 has a larger surface than valve 53.

From what has been said it is evident that high-pressure air enters one side of the valve group and issues from the other side at a reduced pressure. From this reduced pressure side runs a pipe 54, by means of which air is supplied to the gyroscopic spinning turbine 23 at the proper time. This air is also conveyed to the cylinder of the servo motor 23a located on top of the gyroscope 23. In the early short range torpedoes the gyroscope was spun by means of a spring which rotated the wheel at high speed by a sudden impulse. The spinning mechanism passed out of contact with the flywheel shaft after the operation and left it unhampered and free to rotate by virtue of the energy stored in the rim of the wheel. With the increase in range and the necessity for storing a greater amount of energy in the flywheel in practically the same short space of time, it became apparent that a more powerful impulse was necessary. As a consequence compressed air was made to impinge upon a small turbine wheel in the manner shown in Fig. 4. By this device the efficiency of the gyroscope was greatly increased. It was held by some that the utilization of air from the main charge for the purpose of spinning the wheel was undesirable, but the amount of air used is so small that the range of the torpedo is not seriously affected. The only improvements made recently to keep the gyroscope spinning as long as possible have been mechanical refinements rather than important inventions. A little more energy has been made available by the introduction of ball-bearings in the flywheel journals and at the gimbal pivots, thus reducing friction.

After the gyroscope has been spun it must be released from the starting turbine. This release, however, must be affected without jar and without in any way retarding the gyroscope. For that purpose a releasing mechanism has been devised which is so delicate that it accomplishes its purpose within the period of a sixth of a second—the launching interval of the torpedo.

In Fig. 5 the mechanism for releasing the gyroscope after it is spun is illustrated. The flywheel 55 of the gyroscope revolves in anti-friction bearings, carried by a gimbal ring, which is also pivoted at 58 in the ring 59. The gimbal ring 59 is supported in pivots 60 located on a vertical center line. The entire gyroscopic flywheel is inclosed in an outer casing 62, so that the gyroscope and its sub-casing 61 (virtually a frame), may be removed in its entirety from the outer casing 62. The vertical bearings 60 are located in the sub-casing or frame 61, at the bottom of which is secured a plate 63 provided with two openings 64, through which the fingers may be passed in order to bring the gyroscope into alignment with the spinning mechanism. The finger openings are normally closed by a cover plate 65 held tightly against the lower part of the sub-casing or frame 61, so as to make a watertight joint. The hand plate 67 is held in place on the same principle as that employed in the construction of breech blocks of guns. In other words, the principle of the mutilated screw is employed so that the hand plate is first forced into position and then given a short turn in order to lock it in place.

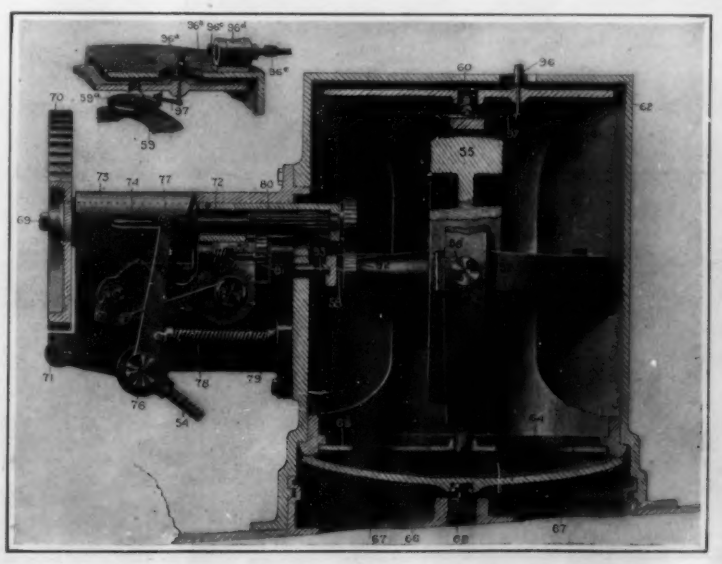


Fig. 5.—The gyro-spinning mechanism of the standard torpedo.

On the turbine shaft 69 the turbine wheel 70 is keyed—the rotor of the turbine. Air is supplied to the turbine wheel 70 through the pipe 54 and the nozzle 71. The shaft 69 revolves in a sleeve 72 within a casing 73, provided with a slot 74. An arm 75 fulcrumed at 76, engages trunnions 77 on the sleeve 72. A coil spring 78 is attached at one end to the arm 75 and at the other to the bracket 79, which is of course a fixture. A valve is provided at 76 to control the flow of air through the nozzle 71. In Fig. 5 the valve is open so that air may flow when the starting latch is pulled. The turbine shaft 69 carries a long pinion 80, which meshes with the gear 81, on the shaft of which is

mounted a worm 82 engaging the worm wheel 83. This worm wheel 83 carries an eccentric 84. By means of the connecting rod 85, the eccentric causes the rocker plate 86, which carries a pawl 87, to engage the ratchet 88. This ratchet 88 is integral with the cam 89, the surface of which engages a pin 90.

On the outer end of the turbine shaft 69 is a gear 91 meshing with a similar gear 92 on the gyroscope flywheel shaft. The gimbal ring 57 is locked in position by means of a pin 93, which falls into a recess and holds the gimbal ring in place, while the gears are in mesh and the gyroscope is being spun. In order to bring the gears 91 and 92 into mesh and the pin 93 into engagement with the socket in the gimbal ring 57, the stud 94, which carries the ratchet and cam 88 and 89 is revolved. As a result the pin 90, and consequently the lever arm 75, will be swung over into the position shown and will be held there by the surface 89a of the cam. As the turbine 70 is revolved and consequently the pawl carrying the rocker plate 86 is operated, the cam 89 will be moved around until the pin 90 is released from the face of the cam through the medium of the spring 78. The lever 75 will snap out of the position shown in Fig. 5, carrying with it the sleeve 72 and the shaft and gear 91.

The pin 93 must be withdrawn, however, before the gyroscope is completely released. The pin remains in engagement with the gimbal ring until the gears 91 and 92 are entirely out of mesh. It is withdrawn by the movement of the stud 94. Lost motion is provided between the movement of the sleeve 72 and the pin 93, so that the gears can be drawn out of mesh before the pin itself is withdrawn. The air which was supplied through pipe 54 must not continue to flow from the tank after the gyroscope has been released, and consequently it is cut off by the valve 76. When the trunnion 77 reaches the end of its travel in the slot 74 the valve carried by the fulcrum 76 is completely closed.

Several methods of transmitting motion from the vertical gimbal ring 59 to the rudder-actuating mechanism are in use, all differing considerably from a mechanical standpoint, but having the common purpose of accomplishing the desired action with as little effect as possible on the gyroscope itself. In the detail view appearing in the upper left-hand corner of Fig. 5, a typical mechanism is shown to convey motion from the gyroscope to the valve gear or the servo motor 23a (Fig. 4). The disk 59a is provided with a single tooth and is securely fastened in the gimbal ring 59 so that it may rotate therewith. The lever 97 is provided with the equivalent of two gear teeth and may be engaged by the tooth on the disk 59a. The lever 97 is attached to a vertical shaft 98, having a small crank 98a at its upper end, attached to which is the piston valve 96b, which slides in the valve casing 96c. This valve is of the balanced type and requires very little power to move it. When the lever 97 is engaged by the disk 59a, the valve will be drawn in or out, depending upon the side to which the torpedo swings around the gyro. In the servo motor 96d (a small air cylinder) a piston is forced in or out, according as the valve opens one or the other of the ports. To the piston rod 96e of the servo motor a steering rod is attached, which runs to the tail of the torpedo and is there connected with the steering rudder crank.

If in steering the weapon is made to over-run the course on the opposite side, the helm is reversed, the operation being repeated until the normal course is followed. The swing of the rudders of a torpedo is very short, and consequently the weapon does not deviate normally very far from either side of the line.

By constant refinement, the gyroscopic steering gear has kept pace with the growing demands which have been made upon it. The United States Government is now having weapons 21 inches in diameter and 21 feet long made—weapons credited with a speed of 40 knots and with a possible range of some 10,000 yards. Except for the introduction of means for spraying water into the superheated air chamber, thereby augmenting the supply of motive fluid available for propulsion, the main principles involved in the design remain practically the same.

Torpedoes, as we have here described them, have their limitations, particularly as weapons for battleships which fight at ranges of seven miles or more. In the first place it must be noted that the torpedo gyroscope persists in its plane of rotation only so long as its velocity of spin is sufficiently great. Hence in all impulse type of gyroscopes—the type previously described and the only type in use—where energy is applied to the flywheel and subsequently cut off so that the wheel may freely revolve by its own momentum, the speed of rotation gradually decreases with the result that as the torpedo nears its mark, the stored energy becomes less and less. Just when the efficiency of the gyroscope should be at its highest, it is at its lowest. No wonder that in long range torpedo firing the gyroscope becomes sluggish, and even "dies" before the weapon reaches its mark. The gyroscope should maintain a practically constant velocity of rotation throughout the period of the torpedo's run. To accomplish this with an impulse spun gyroscope would necessitate the use of such a large flywheel that external auxiliary means would have to be provided for spinning the wheel.

Now that battle ranges have increased beyond the distance at which a gyroscope can be really effective, it is obvious that improvements of some kind are called for. That accounts for radio-control, sound control, and similar schemes. It has been proposed to supply compressed air continuously to the gyroscope for the purpose of maintaining a maximum spin. But if this is done the air must be conveyed to the flywheel in such a manner that when the gimbal rings are free there can be no tendency for the air to disturb the delicate balance of the apparatus. The air would have to be conveyed through one of the pivots supporting the flywheel gimbal ring. While this may be accomplished, a high degree of mechanical perfection would be demanded if leakage of air is to be prevented, and the present anti-friction pivot still retained. A more serious drawback is the amount of air that would have to be drawn from the main air supply to keep up the spin and the necessity of supplying an auxiliary air tank if some form of energy other than air were used for the engines.

If a gyroscope could be spun continuously by compressed air, certain difficulties would be encountered, very prominent and troublesome among which is that resulting from what is known as "wire-drawing" of the air, which is liable to set up a freezing action and which in the case of a gimbal pivot would greatly increase its friction so that it might prove worthless as an anti-friction device.

The present type of torpedo, equipped with an impulse gyroscope, is open to the objection that the operation of starting the engine does not unlock the gyroscope, but merely starts the spinning turbine. By the time the spinning impulse is completed, the torpedo may have veered around, and

(Continued on page 128.)

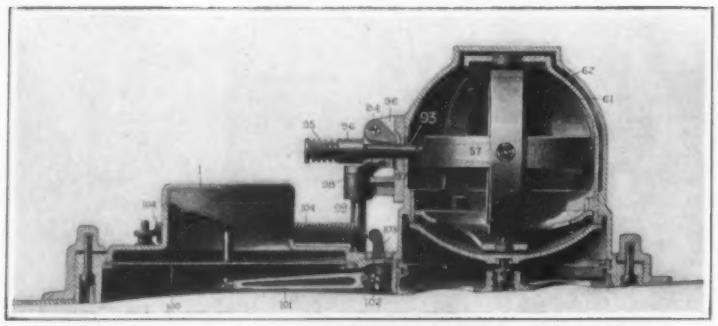


Fig. 6.—The Chandler electric depth gear and continuously spun electrical gyroscope.

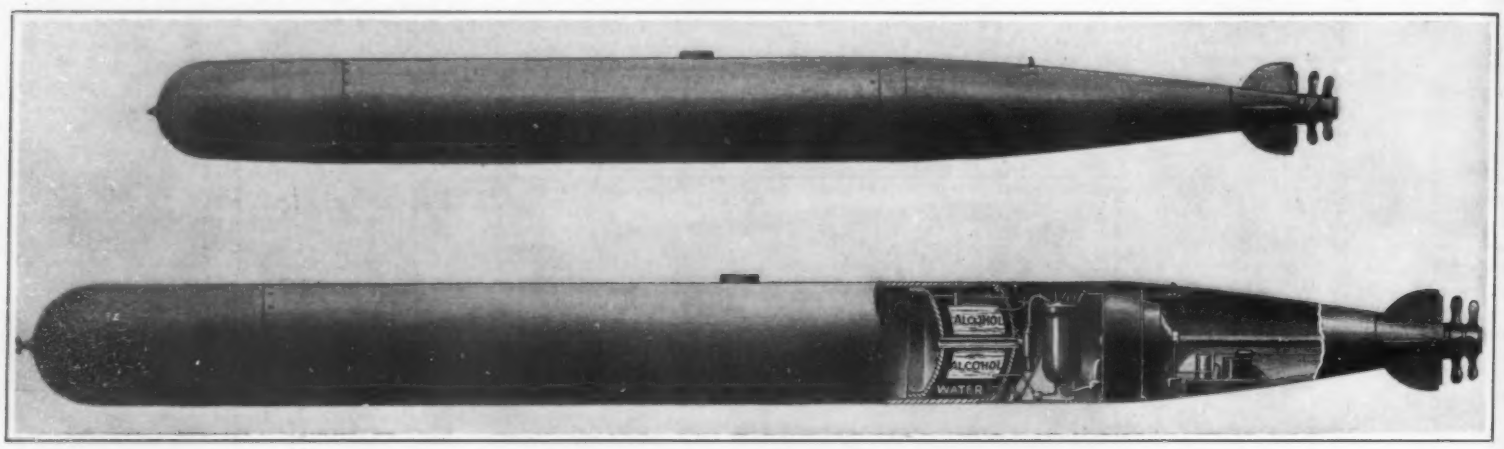
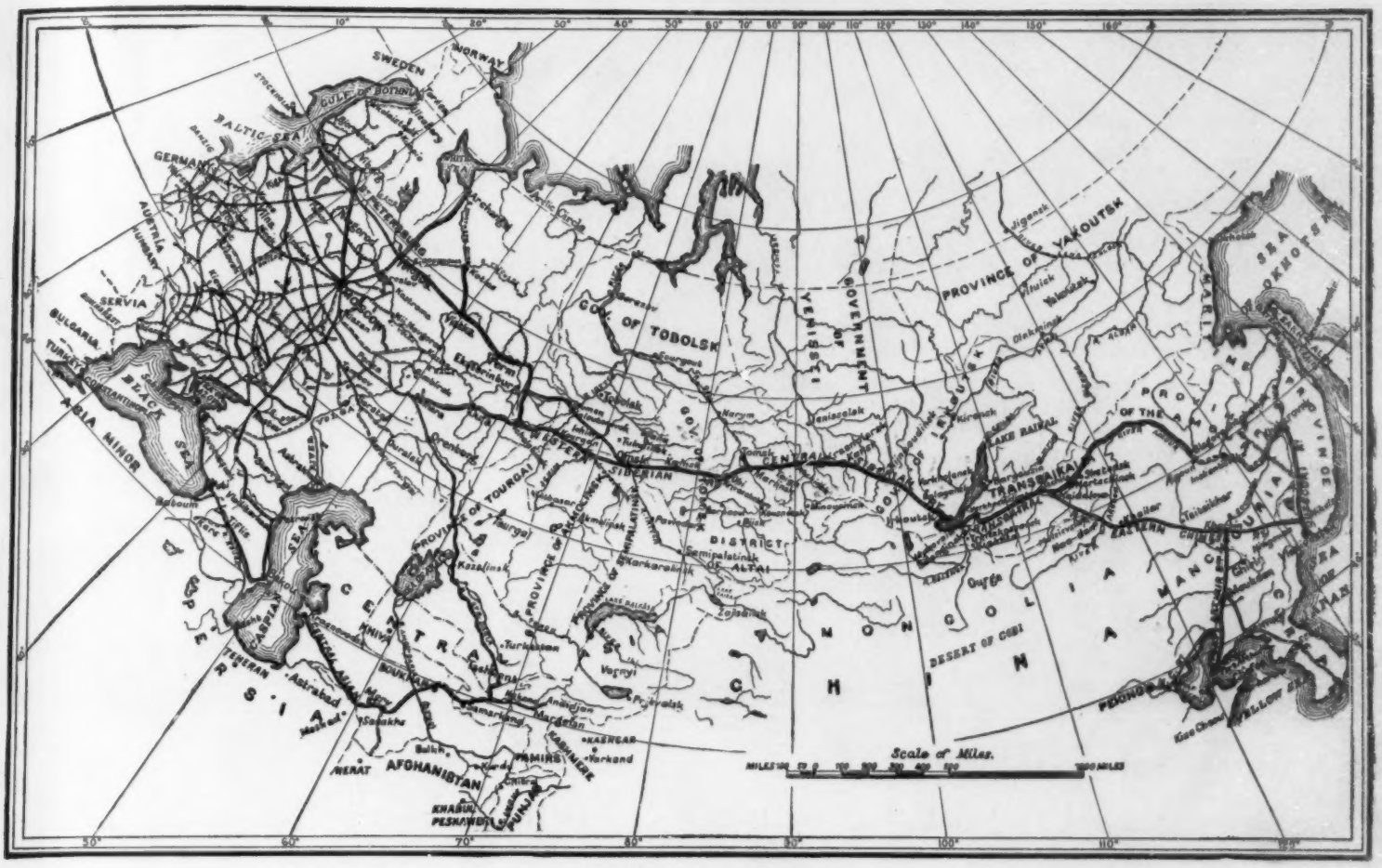


Fig. 7.—The 18-inch torpedo compared with the latest 21-inch, 21-foot torpedo. In the new torpedo the alcohol fuel for the superheater is contained in an annular flask as shown.

Launching a torpedo.



Map of the great Siberian Railway.

Connecticut to Poland by Way of the Pacific

How Munitions Are Shipped to Russia Across Asia

By Henry Harrison Suplee

IT is beginning to be understood that if Russia is to obtain supplies for the conduct of the war from the United States the question of transport is fully as important as that of production. For this reason it is desirable to examine the possibilities of existing facilities, and their influence upon deliveries.

At the present time Russia has but two practicable entrances, Archangel, on the White Sea, and Vladivostok, on the Sea of Japan. Both of these ports are icebound for three fourths of the year, and usually accessible only during the months of July, August, and September. It is true that the Siberian railway system may be reached through the Eastern Chinese Railway, by way of Port Arthur, but Vladivostok and Archangel are the only ports belonging to Russia, and under entire Russian control.

It should, therefore, be realized that whatever shipments of war munitions Russia is to receive from the United States must be delivered within the present summer and early autumn if they are to be used during the present year, and the necessity for promptness, not only in manufacture, but also in shipment is apparent.

The accompanying map, which represents the Siberian railway system, and its connections with the eastern war front, contains its latest developments, and will be found of present interest and value.

The Siberian Railway was originally intended to be constructed wholly on Russian territory, and the route, after crossing Lake Baikal, was planned to follow the valley of the Amour as far as Khabarovsk, there turning sharply to the south to Vladivostok.

When, however, the lease of Port Arthur was arranged with China, in 1898, the route of the railway was diverted southeastward from Tschita, passing directly through the Chinese territory of Manchuria, the line branching south at Harbin to Port Arthur, and east to Vladivostok. Before this diversion of the line of the Siberian Railway was made, however, the main line had been built as far as Stretensk, nearly two hundred miles east of Tschita, while the Ossouri branch, extending northward from Vladivostok to Khabarovsk, had been already completed.

The demands for transport made during the war between Russia and Japan in 1904 led to the completion of the circum-baikalien division of the railway, this difficult piece of work replacing the train ferry system across the lake; and since the result of the war with Japan took the control of the Eastern Chinese division from the hands of Russia, the completion of the original plan for the railway has been felt to be a necessity.

At the present time the route by the valley of the Amour has been extended from Stretensk as far as Blagovechtchensk, leaving nearly six hundred miles yet to be completed before the connection with the Ossouri division is made at Khabarovsk. It is possible, however, during the open season, to maintain river navigation on the Amour to Blagovechtchensk, and there make connection with the Siberian Railway main line, and it is probable that this navigation will remain open about as long as that of the port of Vladivostok.

If the full co-operation of Japan is obtained, it would be possible, however, to ship munitions to Fusan, the treaty port of Korea, from which direct railway connections exist to Mukden by way of Seoul and Antung.

Assuming that goods may be delivered by one of these points to the Siberian Railway, it is then practicable to reach the eastern front of the war in about twelve days, to which must be added the time to cross the United States, and to traverse the Pacific from Seattle or Vancouver to Vladivostok. This latter time may be estimated at about twenty days, so that about one month will elapse before a shipment of munitions from the eastern part of the United States can be expected to reach the fighting line, provided no serious delays occur.

It is interesting to note that the Siberian railway system, originally intended to enable Russia to reach the Far East, may yet become of controlling importance in connection with the transport of supplies in the reverse direction; and that with the co-operation of her former antagonist, Japan, the delivery of munitions from the workshops of the United States across the Pacific and across Siberia may determine the result of the war.

It may be noted that the completion of the Amour division of the Siberian Railway involves some difficult and important engineering problems, notably the bridging of the Amour River at Khabarovsk, and the traversing of the broad stretches of marsh land and forest met in the province of the Amour, but doubtless these will be overcome, and the railway completed in accordance with the original plans.

It is also interesting to note that supplies delivered to the fighting line in Poland from the eastern coast of the United States by way of the Pacific Ocean and the Siberian Railway will have traveled more than twelve thousand miles, or about one half the circumference of the globe.

Germany's Projected Giant Aeroplanes

NOT long ago there appeared a notice in Swiss papers saying that England was building aeroplanes of immense size, able to carry sixteen men. The SCIENTIFIC AMERICAN is informed that Germany will soon begin the construction of similar aeroplanes (triplanes) of enormous dimensions. These machines are to be *three times as big and strong* as the ordinary flying machine. They are to carry as many as twenty men. This crew has to work four machine guns and one light field piece mounted in a special little armored turret. Eight Maybach motors, similar to those used by the Zeppelin airships, are to drive the apparatus through the air. The motors are coupled in pairs and drive four propellers. The propellers may be shifted in position so that they serve for steering in a horizontal plane. Manual steering is resorted to only for elevating or depressing the machine. All other movements are effected by the motors. The triplane will fly with two propellers only, if need be, and travels at high speed when four are turning. The machine is armored.

Son of the Kaiser Officially Disinfected

THAT necessity makes strange bed-fellows has been accepted from time immemorial, and the unexpected occurrences of the war have been so numerous and unusual that we feel little surprised at almost any new development; nevertheless, the incident noted in the following foreign item strikes us as originally strange:

"Prince Adalbert of Prussia, the son of the Kaiser, recently spent two days in Russian Poland. Before his departure the commander of the regiment gave him a certificate necessary for the railroad trip. It was properly stamped and signed and contained the words, 'His royal highness herewith receives due acknowledgment that he has been properly disinfected and for the time being is free from vermin.' Prince Adalbert was amused when he read the words 'for the time being.'"

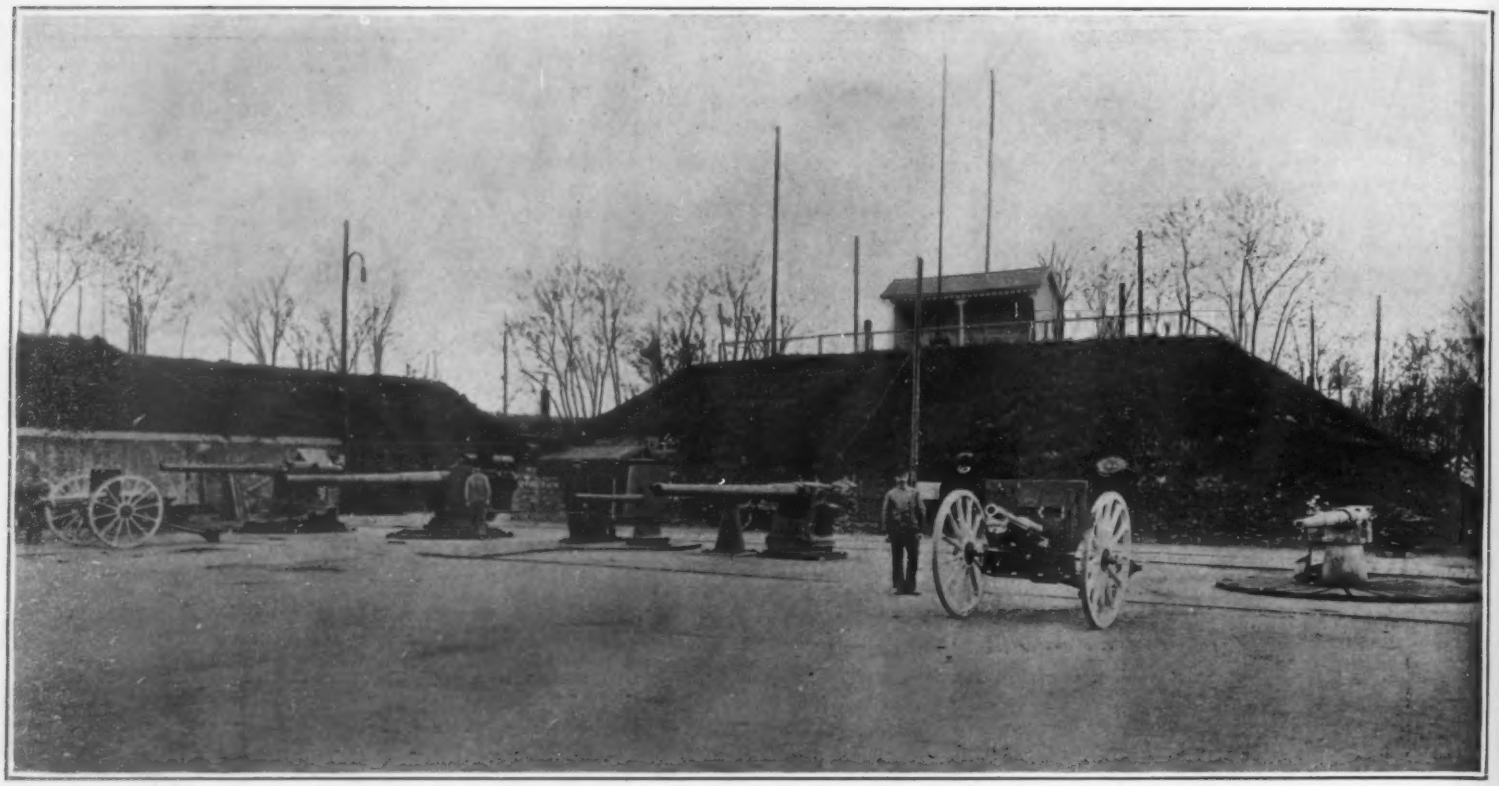


Fig. 1.—Proving ground of Villedieu.

Proving Grounds for French Artillery

A Laboratory Battlefield

By Jacques Boyer

IN the proving grounds connected with great artillery factories, engineers test the guns, projectiles and other artillery apparatus, to insure their acceptance under the specifications established by the governments which use them for their armies.

The Schneider firm have four or five of these proving grounds, two near Creusot, and two near the Harfleur factory. More than 20,000 tests of cannon are made annually at these grounds.

As the country in the immediate vicinity of Creusot does not allow of the establishment of a large experimental field, small proving grounds have been located at Villedieu and Saint Henri, where there are carried on tests of interior ballistics and the effect of fire on armor only. But at Harfleur and Point du Hoc, firing over the land and the ocean has been arranged for.

The proving ground at Villedieu (Fig. 1) covers about nine acres at one end of the Creusot factory. The field is twelve hundred feet long and has an average width of three hundred and thirty feet. Grass-covered embankments insure protection to the surrounding country. The firing is carried on in sand pits, two of which, constructed of reinforced concrete, allow of experiments with guns of the largest calibers, and with heavy conical projectiles. A third pit, only thirty feet deep, is used for tests of small caliber guns. Small special pits are used for tests of fire at 10 to 30 degrees elevation, the large ones being only used for horizontal fire. One of the pits, arranged especially for fire against armor plate, has reinforced concrete bomb-proofs at the entrance and at each side.

A traveling crane of one hundred tons capacity serves the whole series of pits. The gun carriages are mounted on universal platforms, and movable walls of reinforced concrete can be so placed as to protect the artillery against accident while firing. Concrete foundations are built on which turrets of various sizes may be mounted, thus reproducing service conditions, and making it possible to test the effect of fire on turrets having various varieties of armor, as well as the effect on the mechanism in the interior of the turret.

For testing the effect of horizontal fire of field and mountain artillery large emplacements have been arranged for batteries of these guns. Some of these are paved, some have clay soil, while others are of sand or are covered with turf. Behind the embankments and protected by them, are storehouses for various explosives to be used in the experiments. Rooms for chronographs and for testing the materials, and storehouses for shells, cartridges and projectiles, and a photographic laboratory, complete the establishment.

As no trials can be carried out at Villedieu except with horizontal or low elevation fire, a second proving ground, that at Saint Henri, has been installed on the site of some ancient quarries, which is designed for high elevation fire, especially for howitzers. The entrance through a narrow passage leads to the elliptical firing ground, which is surrounded by a wall sixty feet high in the line of fire. On the side of the rocks is a masonry chamber filled with sand. This chamber is wider toward the top, and has an opening which serves as a target. Here tests are made of siege guns, or those of large caliber, firing at an angle of 70 degrees.

The proving ground at Point du Hoc, near the mouth of the Seine estuary, is designed for fire at long range over the ocean or river. There are also pits for experiments in ballistics. The property covers about eight hundred acres and is connected with Havre and Harfleur by railway. There are two batteries, the first having five platforms, for guns of all calibers; fire can be directed either to sea or into the sand pits. A traveling crane of eighty tons capacity is installed. The other battery has two platforms arranged for guns of small or medium calibers; it is placed on the dike which protects the firing field from the Seine on this side. A large double sand pit has been constructed for use with large cannon with service charges. Since its establishment, the Schneider firm has tested cannon for Bulgaria, Chile, Spain, France, Italy, Japan, Peru, and Portugal.

The proving ground at Harfleur is very large. It is in the immediate vicinity of the Harfleur factory, between the Tancarville Canal and the Seine, and extends from east to west a distance of ten miles. The country is perfectly flat. This ground is used for testing new types of artillery, the establishment of firing tables, precision firing at long distances, the firing of explosive shells, and for experimental work of all kinds.

The battery emplacements and buildings connected with them cover 1,500 acres, the buildings themselves covering 100 acres. The batteries are a thousand feet long and have platforms for firing under most diverse conditions. There are grooved platforms for fortress or coast artillery, oscillating platforms for naval guns, stair-shaped platforms for firing field artillery at high angles, platforms of macadam, of sand, of brick, of reinforced concrete and of natural soil, and platforms on an incline. There are casemated shelters with armored observation positions for watching the effects of shell fire, and for experiments with various explosives and projectiles and with over-charge firing. The covered observation gallery, placed, as is shown in Fig. 2, on an embankment at the rear of the battery, gives a view all over the field, and has a complete outfit of instruments for optical observation. Three lines on the field show the limits of fire, and signal posts every fifty meters serve to measure the distances. A sand pit, placed in front of the batteries, makes the observation of test firing and interior ballistics an easy matter. There are on the field numerous structures to be used as targets, such as walls of brick and concrete, bomb-proofs, and temporary fortifications against which shells may be fired; these are rebuilt after the tests. They are so placed as to serve for testing precision fire and its effect.

A railway with 24-inch gage runs the whole length of the field and has lateral branches running perpendicularly, or across the line of fire. By the use of this railway, targets can be placed anywhere, and it serves for the transport of guns and ammunition. From armored or concrete shelters along the railway the effect of fire can be observed. There is a complete telephone system connecting with the batteries and the registering apparatus. An armored train can also be run along the railway to any point. All of the Schneider proving grounds have a meteorological station, chronographs, wireless telegraph instruments, preparation rooms, storehouses for ammunition, parks for cannon, an industrial railway, and a photographic laboratory.

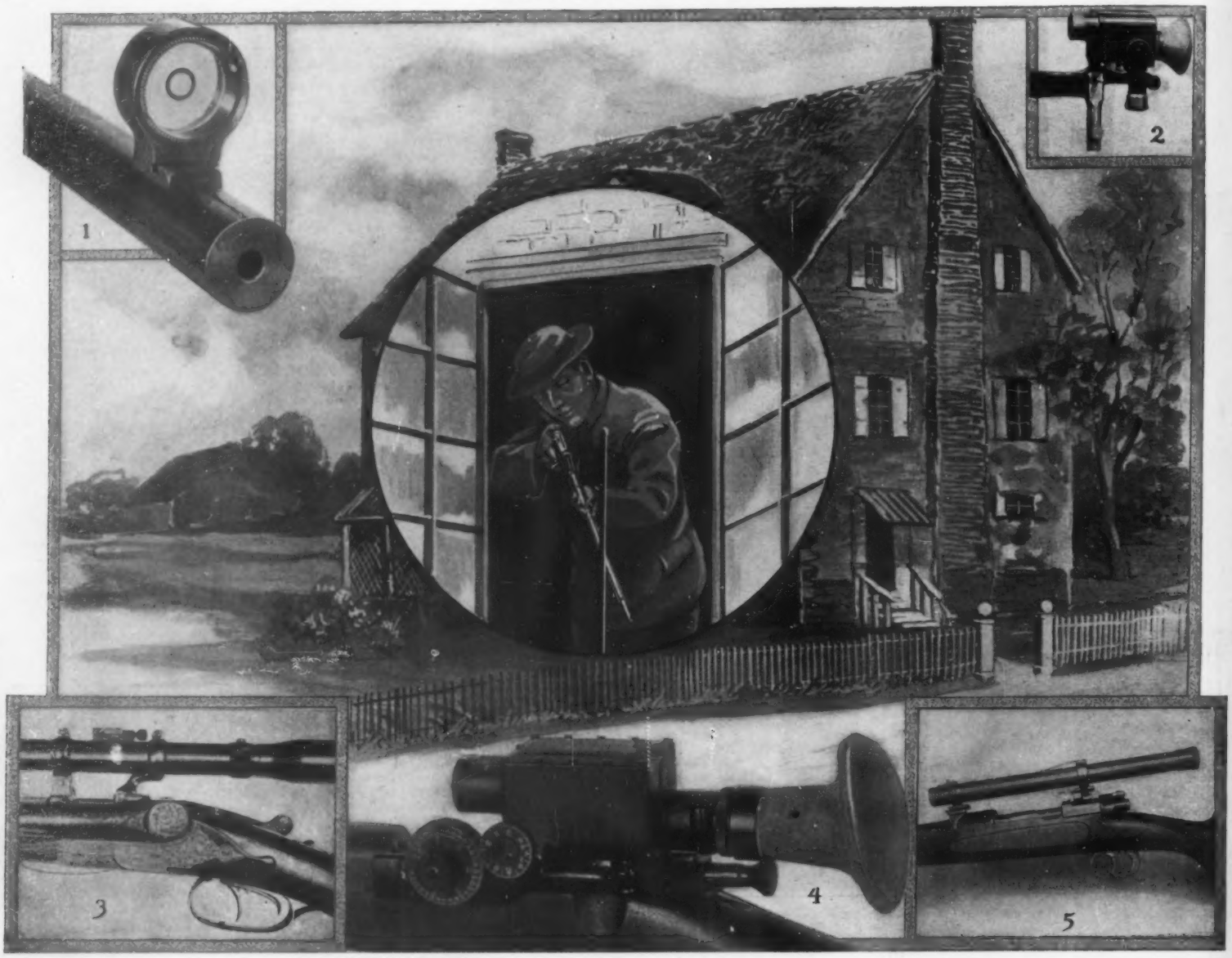
Among the other proving grounds for French artillery, we illustrate the field of Langonand (Fig. 3), belonging to the Compagnie des Forges et des Acieries de la Marine, but a detailed description of this would not be of great interest to the reader.

Kinematography of Projectiles

A METHOD of photographing moving projectiles by daylight, with a modified motion picture camera, is described in a note which *Prometheus* quotes from *Photographische Korrespondenz*. By using a rotary shutter with three open sectors, instead of one, three photographs of the projectile are impressed on the same segment of the film, during a single pause of the film, which has a width of 4.8 inches, about four times the usual width. It is possible to shorten the exposure to 1/2,400 second, if the lens is very sensitive and the projectile contrasts strongly with the background. In this way the inclination of the projectile and of its path at the beginning and end of its flight can be determined. The initial and final velocities can be measured by including a moving clock hand in the picture. For the precise determination of the positions of the projectile near the beginning and end of its flight it is photographed in two mutually perpendicular planes with two cameras. By using a camera with four lenses, each covering a quarter of the width of the film, and an ingeniously constructed shutter, several phases of the emergence of the projectile from the muzzle can be photographed. These data are of weight in ballistics.

Fig. 2.—Proving ground at Harfleur.

Fig. 3.—Proving ground at Langonand.



1. An English lens fore sight, giving 2½ magnification, and, within a smaller field, the same effect as a telescope sight. 2. First model of the American service sight, showing prism box. 3. A closer view of a German non-prismatic telescope sight. The disk on the tube is for elevation. 4. The new American telescope sight. 5. A telescope of the American target type, terrestrial construction, without prisms, mounted on a German Mauser. This telescope is not adapted to military work because of the small field, poor light and great length. The central picture gives one an idea of what a sniper would look like through a German telescope sight.

Telescope Sights for Fighting Rifles

Increasing the Efficiency of the Infantryman

By Edward C. Crossman

NOT so very long before the war a British shooting authority and member of the War Office Small Arms Committee expressed himself in this wise:

"The best of telescope sights is simply unthinkable for war."

Evidently his government agreed with him—and now is sorry.

The British War Office is hurriedly entering into the American market with orders for telescopic rifle sights—the more and the quicker, the better. The factory making the only American telescope sight adapted to the military rifle is working night and day, and praying for more German optical glass to use in filling their British orders.

The very full and satisfactory reports from the front (this is intended as a joke) divulge the fact that the German sharpshooters, with telescopic rifle sights mounted on their straight shooting Mausers, made the British and French trenches about as safe as sitting over an open and full powder keg with a lighted pipe. Sniping as practiced by the Germans, became a fine art. A glimpse of a head at an embrasure, the suspicion that a foeman crouched in the concealing obscurity of weeds or straw in the field—and immediately a German telescopic rifle sight dropped its brilliant field over the spot, a pointed picket in the field of the glass touched the object to be hit, which was of course magnified from three to six times, and immediately thereafter the casualty list became swelled by one more name.

Naturally enough, the French and the Belgians suffered as much as did the British, but the British bitterly resent being sniped. Scorning the shooting of the Germans, and proud of their own marksmanship they regard accurate sniping as their own prerogative. After the high training of their regular force in rifle shooting, and after the few hundred thousand civilians that have been following short range rifle shooting in the United Kingdom, they feel that if there is any extemporaneous shooting to be done, they are the ones to do it.

It turns out that one or two men in every German infantry company, the most skilled shots—the "acorn" men of the organizations, possess rifles fitted with telescope sights. There is no disputing the high accuracy, the flat trajectory, and the general superiority of the German Mauser to any of the other rifles, and there is equally little use in disputing the fact that the German can shoot if he turns his attention to that game. So came about the regrettable fatality among the Allies in the desultory fighting during the winter, and the high percentage of killed among the British officers.

John Bull tells us little about how it feels to be receiver-general for the bullets of the telescopic sighted German rifles, but the frenzied orders he has sent to American factories is language that is very full and comprehensive.

Evidently "The best of telescope sights is" no longer "unthinkable for war."

The worst of the British situation the British War Office is just beginning to find out—this being that the Germans have developed the telescope sight, and with the exception of Warner & Swasey of this country, make the only practical instruments of this sort for the fighting rifle.

The telescope sight has three distinct virtues for fighting purposes. They are these: It magnifies the suspected objective just as a low power telescope of ordinary sort would do, showing whether or not there is anything at which to fire. It enables the soldier to lay the sight accurately on a partly concealed and badly lighted mark that would be invisible over metallic sights. It acts to some extent as a range finder if the user becomes trained to note the approximate size of the objective and the needle in the field of the glass.

Needless to say, the virtue of allowing the soldier to aim accurately at a nearly invisible objective is the chief one.

Optically the telescope sight is a terrestrial telescope of low power, rarely going over six power or six linear magnifications for practical work because of the loss of light and field of view that follows higher powers. The best types are the prismatic, like that used on the United States army rifle.

In this instrument, and in similarly constructed ones like the Zeiss of Germany and the Goerz, the image, gathered by the large objective lens, is brought right side up again from its inverted position by a prism or prisms, and then is delivered to the eye by the bright and simple astronomical eye-piece. In this it follows out the construction of the well known prismatic field glass.

In the Zeiss and in the Warner & Swasey, used by the American Government, the prisms shorten up the instrument into an elbow-joint affair instead of the long, more bulky tube of the ordinary telescope with a set of plain terrestrial lenses.

The line of collimation of the lenses is the aiming line. Placed within the glass in most of the German instruments is a little steel needle, sharpened at the top and extending just half way up the field as seen by the eye. It is magnified by the eye-piece until it appears

possibly the width of a man at 400 yards. The process of aiming consists of nothing more than placing the sharpened end of this picket on the thing to be hit, which is of course magnified by the instrument.

So the soldier sees through the glass, perched on the rifle, just the view that one would see through a low power telescope of the finest possible construction, but sticking up half way across the field is this steel picket, to be placed on the object to be hit. The instant the magnification of the lenses tells him that the suspected object needs shooting, he gently touches it with the needle and squeezes the trigger of the powerful rifle.

Adjustment for range with the German glass is obtained by turning a milled dial set on top of the tube. In turn this moves the frame in which the sharp picket is set, raising or depressing it. As it is like a front sight, lowering this picket in the tube raises the muzzle of the rifle again to bring the point back on the thing to be hit. So, depressing this picket alters the sighting for longer range. This dial is graduated for range.

The German glass is usually fastened to the rifle by fixed steel hooks on the glass itself, that drop into corresponding recesses cut in plates screwed to the rifle. The pressure of a lever or catch frees the hooks and allows the glass to be detached.

The American Government adopted the Warner & Swasey instrument in 1908, and later on decided to issue two telescopic sighted rifles to each infantry company, the best shots of course drawing them. Possibly some secret tip from our military attaché in Germany decided our army men to do this, but our own telescopic rifle sight is carried out to a much higher form than any of the Continental instruments—for military purposes.

It is this instrument, or a close approximation thereto, that the British are now buying for their army.

The American army glass is about seven inches long and looks like a little steel box with a tube protruding from either end. In one tube is set the object glass, in the other the eye-piece. A rubber eye cup is fitted to keep out extraneous rays of light, and regulate the distance from eye to glass. It is hardly necessary to say that the optical construction of this and all similar telescope sights must allow the eye to get the whole field of view, and stay from two to three inches away from the eye lens. The recoil of the rifle makes closer acquaintance very unsafe. For this purpose the eye-piece is made very large, thus affording the necessary "relief" between the eye and the lens.

The United States Army glass is mounted on a steel plate screwed to the side of the new Springfield, and the instrument extends back over the stock to the comb.

Elaborately engraved milled dials on the left side of the mount give elevation up to 3,000 yards, and "windage," or lateral movement as well. Porro erecting prisms occupy the little steel box, and a fine Steinheil triple achromatic lens is used for the eye-piece.

Instead of the picket point of the German glass, the American telescope is provided with a plain glass lens, or "reticule," on which are etched horizontal and vertical lines, the cross-hairs of the familiar surveyor's transit. "Stadia" lines are also etched on this glass, so spaced as to span the height of a man of 5 feet 8 inches at 1,000 yards. This much to make the telescope a range finder as well as a telescope. The power is six, that is an object is magnified six times lineally, a foot-high post is made to appear six feet high, etc. The aiming point of this glass is of course the intersection of the cross-hairs or lines etched on the plain piece of glass inside the tube.

The elevation and windage of the glass is altered by the milled dials bearing on levers on which the whole glass is pivoted. On top of the instrument is an engraved table giving wind and range and drift figures.

The instrument is of course devised for the use of the most skilled long range shots—the close range trench sniping of the German-Allies fighting probably not entering into the calculations of the designers. For this sort of work the American glass would be better in a lower power of magnification, with the added light and field of view that comes from the lower power. Quick snap shooting—or the semi-snap shooting that a sniper would do at heads appearing over an opposing trench within a few hundred yards indicates a wide generous field, and plenty of light for the poorest conditions.

One of the most useful features of the telescope sight of adequate light, is the fact that it makes possible accurate shooting in the dusk, when metallic sights could not be alined on even a contrasting objective.

Carbureter Heating.—A European patent consists in an electire method of heating the gas mixture of the carbureter, expecially at starting the motor when this is cold, and thus it assures an easy start and good gas conditions for carbureter with all fuels such as benzol or alcohol. The electric heater consists of fine German silver or other wire wrapped around a thin tube of metal and insulated with mica and asbestos or other suitable material. This wire is brought to a high heat by the current.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Practical Devices and the Lack of Capital

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial and Mr. Atwater's letter in the issue of May 29th both point out a crying need for the good of the country. Mr. Atwater suggests that a "captain of industry, or some syndicate" could have taken advantage of Mr. Porter's fertile mind and "the world would have been the gainer." This of course can be said of almost any fertile mind, and it is probably out of the question to expect any arrangement to make use of all the possibilities.

But there are bright exceptions and it is a disgrace that the powers that be and the business men of this land have not long ago made some arrangement to exploit properly the waiting opportunities for adding to our national wealth. We see almost every year "bread lines" and "soup kitchens" feeding by charity men who would be proud to earn their living if they could find work. We hear constantly reports of "no work" and yet all around us are undeveloped devices that would give work and add much wealth to the world if somebody would take them in hand and develop them.

While not so noticeable there is undoubtedly plenty of capital waiting for more profitable employment and plenty of men with money anxious to get in touch with some device in their line that offers a chance to make a good profit. That many great things lie unheard of for years is due simply to lack of means for bringing them together. The man who specializes in manufacturing or selling is not often also an expert in devising. The man who spends his life searching for new things can hardly expect to be an expert manufacturer or salesman.

The Wright brothers spent years of time and all the money they could get learning how to fly. Having accomplished this wonderful feat, tried for since the dawn of history, they then could find no one who would finance them and help them to get their devices on the market. After some years they were forced to go abroad and found their needed help in France. Unpatriotic and unbusinesslike to say the least. Yet undoubtedly there were many men of wealth and business ability who would have been more than glad to have had a chance to take these men in charge and win a name with them as well as make money for all concerned. The problem was to find them. No machinery exists for that purpose. The old "needle in a haystack" method is the only one available.

The automobile is another example. The first successful modern automobile was built in Springfield, Mass., in 1891-2. Others followed and won the first two and only contests of importance in America and the first contest in Great Britain. These contests were held in 1895 and 1896. Many attempts were made to find capital. The leading bicycle and carriage makers were appealed to; as were men in many other walks of life. But the inventor, having spent his money producing the article, had none left to find the factory connections needed. He was not offering a patent or a mere idea, but a thoroughly tested and demonstrated vehicle, the fame of which was even then world wide.

He failed to find the help needed. The gasoline automobile languished and it was not until several years later that the little toy steamer with money behind it was put on the market in quantity and sold faster than it could be made. The biggest part of ten years had slipped away before the great public learned that the gasoline automobile is the most practical one and the manufacture of them began to assume a prominent position. In the meantime other countries had gone ahead making gasoline cars, and for years we had to go abroad for the best, although our own land had at the first clearly the lead.

Letting opportunities slip through our fingers for other countries to pick up is certainly not good business. Every State could well afford to maintain a bureau to help remedy this lack. Certainly this great United States should have such a bureau. It is even more important that the factory and the article get together than it is that the man and the job find each other. The man who has the factory and the article to make will find the men, for he knows men can be found; but lacking the article he knows not where to look.

The bureau should be known to be open to consider any device that has been put into practical or actual use. It should have such connections with practical men in every line that it can submit these devices to them for opinions. It should, after being satisfied that the device has merit, bring it and the organization that can make and market it, together and stand over them to see that failure does not result from lack of capital, experience or modern methods of making and selling.

The inventor should know that with the bureau standing sponsor for his device it will not fail from lack of proper pushing, and that he will get a fair share of the profits that arise. The manufacturer should know that the bureau's investigations cover the subject far better than he himself can, and that his chance of hitting a winner through the bureau selection is far greater than trying to pick it unaided. The bureau should be largely supported by the Government, but could with propriety receive a percentage of the part that may go to the inventor.

Such bureaus would save the manufacturers much time by weeding out the valueless things; complete indexes of experiments would save much repetition of experiments; but the great gain would be that the really valuable things would get into the market, making the country richer without loss of time. It is foolish to cry "Poor Business" and not make the effort to make business good. CHARLES E. DURYEA.

Philadelphia, Pa.

The Three-wire System

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of June 5th, 1915, page 575, you state that the three-wire system of direct-current distribution was first put into commercial operation in 1883 at Sunbury, Pa. Between 1868 and 1873, George H. Snow, who was the draftsman and mechanic employed by the Hall railroad signal system, wishing to place several electric batteries together in one house that had to be heated to prevent the batteries freezing, found trouble in that his signal that was nearest the battery short-circuited those farther away. To obviate this he invented the three-wire system. Henry, inventor of the Henry rifle, was personally acquainted with Snow at that time and must have known of Snow's use of the three-wire. George Coe was a partner in the firm of Snow & Coe of New Haven, Conn., and if he is alive no doubt he could give the precise year that Snow first used that system. Hall's patent should mention this use. E. H. HAWLEY.

Washington, D. C.

Deflecting Rays Downward

To the Editor of the SCIENTIFIC AMERICAN:

The article on page 345 of the April 10th issue of the SCIENTIFIC AMERICAN is of more than passing interest to me, and if I may be permitted, I would like to contradict the description that you have given.

This description would be correct provided the lamp's illuminative filament was in the exact center of the lamp globe, because then the reflected rays from the reflective surface of the small bowl would impinge upon the upper portion of the reflector at the same approximate angle as the light rays direct from the filament. In adjusting the lamp globe in the headlight for use with the bowl you mention, the lamp itself is set in such a position that the upper portion of the reflector will reflect its rays below the line of the horizontal axis of the headlight. Then the other light rays from the small bowl will strike the upper reflector at a different angle, and naturally will be in turn reflected at a different angle.

By a careful study of my statement you will find that I am correct. I have done a great amount of experimenting along this line, and would say that light projection by means of a parabolic reflector is more complex than it would appear to casual examination. Also, this kind of light reflection cannot be calculated theoretically for the reason that it is impossible to obtain a perfect reflective surface, and it is also impossible to obtain a source of light emanating from a perfect point.

Denver, Col. R. F. WILSON.

Sir Sanford Fleming

SIR SANFORD FLEMING, the Canadian engineer and scientist who was instrumental in getting Greenwich time adopted by the railways of the United States and Canada, died recently at Halifax at the age of eighty-eight.

He was a Scotchman by birth, born at Kirkcaldy. He emigrated to Canada in 1848, where he was connected with railroad matters a large portion of his life, having been associated with most of the large enterprises of that kind. He was the engineer of the Northern, the Intercolonial, and for several years chief engineer of the Canadian Pacific, of which road he was called "the Father."

His later years were devoted to literature and scientific research; and he served many years as chancellor of Queens University. He received many honorary degrees, and a number of decorations had been conferred upon him. He wrote a number of books, among which were "Time and Its Notations," "Memoirs of Universal Time and a Prime Meridian for All Nations" and "The New Time Reckoning."

A Dynamic Conception of the Organic Individual

ORGANIC individuals may be completely isolated, or they may be partly isolated, like the members of colonies of lower animals, and the growing tips and associated parts, in trees and other multi-axial plants. All except the simplest individuals develop in orderly sequence in space and time, producing a definite form and structure which remain nearly constant in successive generations. Most theories of the organism fail to account satisfactorily for this orderly development.

From the results of fifteen years of experimental study, C. M. Child of the Hull Zoological Laboratory, University of Chicago, has drawn certain conclusions, which he has set forth in the March, 1915, issue of the *Proceedings* of the National Academy of Sciences, from which the following abstract is taken.

All axiate forms examined, including species of infusoria, hydroids, worms, starfish, sea urchins, fishes, and amphibia, show, at least in early stages, a gradient in the rate of metabolism along the chief axis. The region of highest rate always becomes the apical region, or head, if there is a definite head.

This gradient can be distinguished in various ways, for example, by susceptibility to poisons, which generally varies with the rate of metabolism. Lack of oxygen, high temperature and other conditions give the same death gradient. For very weak narcotics the gradient is reversed because the region of most rapid metabolism is the most quickly and completely acclimated.

There are similar gradients along secondary axes and planes. In most symmetrical forms the rate of metabolism decreases from the middle toward each side. In early developmental stages it decreases from the dorsal spinal cord toward the front of vertebrates, and from the ventral nerve ganglia toward the back of invertebrates.

Plants also show metabolic gradients along axes, growth, for example, being most rapid in the apical region.

In general, a region of rapid metabolism dominates regions of slower metabolism and, when established in any way, produces a gradient by the transmission of its changes with gradually diminishing intensity. This holds good for the transmission of nervous impulses.

In the experimental combination of pieces of *Planaria* into new whole animals, the author finds that no piece can produce parts anterior to itself, unless a head first begins to develop, but that any piece can produce parts posterior to itself, even in the complete absence of a head.

The organic individual is a physico-chemical complex with one or more reaction gradients, and physiological correlation depends primarily on transmission of chemical changes rather than on transportation of chemical substances. Specific substances play important parts in development, but the individual must exist as an orderly whole before they can act in an orderly manner.

It appears from various evidence that the region of rapid metabolism which determines the gradient owes its origin to external factors. Hence, the polarity and symmetry of organisms are not fundamental properties of protoplasm, and are not comparable to physical polarity and symmetry due to atomic or molecular constitution. Probably, however, no cell mass can exist long without acquiring gradients due to unequal action of external factors at different points of its surface.

The length of the principal gradient is the physiological limit of size. If this is exceeded, the outlying portion becomes isolated physiologically, and, in most plants and lower animals, reproduction of some sort results. When some worms attain a certain length, the posterior part becomes a new worm, and in plants a new bud arises at a certain distance from the one previously formed.

These reproductions have been controlled in plants, and the author has controlled them in animals. Growth is not necessary, for the physiological limit can be decreased, for example, by cutting off the apical region, which lowers the rate throughout, shortens the gradient and isolates the remote parts. Sometimes the individual breaks up into many new individuals, or even single cells, as in many cases of spore formation.

This conception of the organic individual accounts for orderly development, asexual reproduction and many curious facts of regeneration and form regulation. It also makes the development of the nervous system and its dominant cephalic region less mysterious than it has been heretofore.

New Method of Producing Albumen

GERMAN scientists have discovered a new method of producing albumen which is likely to have far-reaching results. Its immediate effect in blockaded Germany is to increase the consumption of sugar and to make it still more valuable.

The story of the discovery is told in the *Kölnische Zeitung* of Berlin, which says: "As is known, there are plenty of carbohydrates at hand in Germany, derived from potatoes, sugar, and food beets. So far, however, foodstuffs rich in albumen, such as barley, we have had to import. Now the Institute for Fermentation-Industrie, at Berlin, has succeeded in inventing a process by which feeding-yeast, with more than 50 per cent albumen, is produced from sulphate of ammonia and sugar.

"The new process is very simple and existing yeast factories can start immediately the manufacture of the new article without changing their installation. By the new process 100 pounds of sugar and 52 pounds of sulphate of ammonia yield 270 pounds of dry feeding-yeast, containing 50 per cent albumen. Being in the position to produce ammonia from the nitrogen of the air, we may say in the future albumen will be made artificially from the air."

Germany imports annually about 6,000,000 tons of feeding-stuffs, principally barley for cattle. This amount of provender contains about 10 per cent, or 600,000 tons, of albumen. Accordingly, it would require about 440,000 tons of sugar to replace by the new process the forage which cannot be imported at present owing to the war.

The discovery is of importance to the United States, it is said, both in restricting future exportations of barley, as well as in affecting many industries, albumen being used in making photographic materials (plates and films), calico printing, and in numerous other lines.

The Growth of Armament in the American Navy

TO illustrate the enormous increase in armament in late years, the diagram represents the broadside of ships of the American Navy (including guns of 5-inch caliber and over). A ship has been taken (as nearly as possible) every two years, and the total broadside weight shown in pounds. For the first ten years little difference is apparent, small variations being generally due to alteration in the disposition of the guns. The first great change appears in the "Michigan" in 1908, marking the beginning of the dreadnought era. The rapid

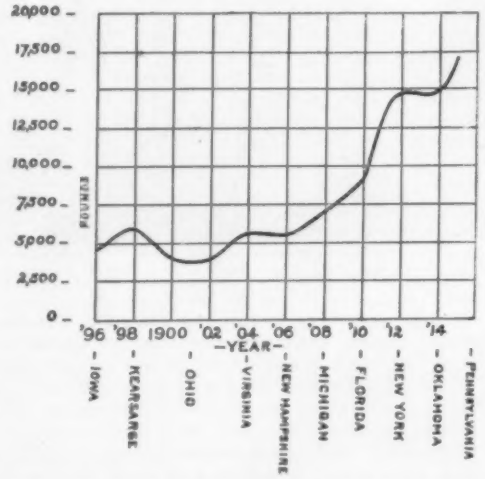


Diagram showing increase of weight of broadside of American ships in twenty years.

growth in weight of broadside from this date is very marked and at present shows no sign of abatement.

This great war will prove an invaluable guide to naval designers, but, so far as can be seen, the cry of the torpedo-man "guns is dead" seems to be a fallacy. And the submarine, which was held by many to mark the doom of the capital ship, has been much overrated, for France, herself one of the belligerent powers, is about to build four ships one and a third times as powerful as any she has previously contemplated.

It may be added that as far as can be ascertained, none of the powers fighting in the great war are abandoning the big ship or the big gun.

Changes in Shade, Color and Pattern in Fishes and Their Bearing on Certain Problems of Behavior and Adaptation

UNDER this title S. O. Mast of Johns Hopkins University has published in the *Proceedings* of the National Academy of Sciences, April, 1915, some results of observations and experiments made at the U. S. Biological Station at Beaufort, N. C. The work is to be published in full in the *Bulletin* of the U. S. Bureau of Fisheries.

Nearly all fishes simulate their environment to some extent, and some flounders do so with remarkable accuracy and rapidity. It was found that flounders in glass dishes became nearly white on a white ground, and nearly black on a black ground. They also assumed approximately the colors of all grounds, except red. Fine and coarse patterns in the ground produced correspondingly fine and coarse patterns in the skin, but there was no actual reproduction of patterns. Five days' sojourn in a black pan was required to produce maximum blackness in a flounder that had been kept two weeks in a white pan, but the change from white to black was effected in two minutes in the same flounder, after it had been transferred frequently from one pan to the other. The change from black to white always required an hour or more. Color changes are comparatively slow. Yellow, usually predominant in the environment, is assumed more rapidly than green or blue.

The skin of flounders contains black and yellow cells, called chromatophoses, and opaque white cells, called iridocytes. The changes in color and pattern are produced by changes in the arrangement of the colored cells and in the extent to which they are hidden by the white cells. These changes are regulated by ocular impressions. Flounders become uniformly white when the head end is placed on white and the tail end on black, they become black when the head is on black and the tail on white, and they become gray when one eye is on white and the other on black. Exposure of one eye to a fine and the other to a coarse pattern produces a combination of a fine and a coarse pattern in the skin. The influence of each eye extends over the entire body. The skin becomes yellow when a yellow card is placed very near the head. A flounder deprived of one eye simulates the background quite normally, but there is no simulation whatever when both eyes are removed. Flounders fail to simulate the ground in very strong illumination from above, and they become white on all grounds when their eyes receive no light directly from above. Adaptation to the ground is not affected by covering the skin with sand, so that the fish cannot see it.

Vision in fishes is very like human vision in regard to shade and color, but less acute in regard to size. Flounders distinguish between dots of 2 millimeters and 3 millimeters, and recognize dots of 1 millimeter, but not those of 0.5 millimeter. By means of a rotating background of black and white sectors the acuteness of vision in regard to motion was found equal to that of man. Flounders adapted to a given color seek grounds of that color, and color in the skin is produced only by exposure to the same color. Hence, flounders have color-vision, but this does not prove that they have color-sensation.

The Current Supplement

TWO articles in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2066, for August 7th, 1915, give a great deal of timely information in regard to the use of searchlights in warfare. The first, Watching the Enemy from the Fighting Line, describes various types of apparatus used by the armies, and tells of the different conditions of operation. The subject is illustrated by a number of photographs. The second article discusses the visibility of distant objects as affected by searchlights. A number of points are brought out that will be appreciated by everyone who is following the technical features of the present war. An article that will appeal to every scientific reader is the discussion, Is the Organism a Thermodynamic Mechanism? The dissemination of news and methods of long distance communication are of interest to everyone, and in this connection is an illustrated description of an extremely ingenious long-distance printing telegraph. Many systems have been brought out for this purpose, but the one described in the present article has successfully overcome many difficulties, and is now being used every day in actual service. The Limits of Experimental Investigation takes up the questions of the measurements of extremes of temperature, of short periods of time, and of minute weights and lengths, and their effects on science. Another timely article is that which describes how an army is provided with pure water, and the subject is made clear by a series of sketches. The Medicine of the Old Testament develops a new and original field of inquiry that will clear up many questions that have undoubtedly occurred frequently to students of biblical matters. The amateur enthusiast in wireless matters will find a wide fund of information, and material for experiment, in the description of the construction of a home-made wireless photo-recording set, which is accompanied by a number of detailed working drawings. A subject of importance to every inventor is that of the compulsory working of patents, a proposition that is frequently brought forward. Much light is thrown on the subject in an excellent exposition of the laws of various countries, and extensive extracts from a discussion at a meeting in England give some interesting results of the practical working of the law in that country. Hydrated lime is a comparatively new article of manufacture in this country, and some valuable information is given in relation to its production and some of the advantages of its use. There is also a very practical comparison of the steam turbine, the reciprocating marine steam engine and the Diesel internal combustion motor, which presents a great deal of much desired information.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

COMBINATION SUIT.—W. K. JONES, 1503 Holyoke St., Wichita, Kan. The jacket or body is connected integrally at the front with the trousers and the latter have a sanitary drop flap at the back and the jacket is provided with a depending flap adapted to overlie and cover said drop flap, together with the pockets with which the drop flap is provided, the depending flap being secured to and over the pockets by buttons attached to the latter.

HAT LINING, BANDEAU, AND SIMILAR ARTICLE.—M. GRÜNIG, Guildford Bldgs., Luton, England, and A. H. WOODFIELD, 41 and 43 Guildford St., Luton, England. This invention has reference to bandeaus, hat linings, and similar articles constituted by flexible material distended between a hoop and a draw-string provided with means whereby the effective length and tension of the draw-string may be varied at will.

KEY HOOK.—J. W. MINNICH, 468 W. Olsy St., Reading, Pa. This invention refers to key hooks, and has reference more particularly to hooks adapted to be secured to a garment. The object is to provide a key hook on which

KEY HOOK.

a suitable key ring may be supported, and whereby the accidental displacement of the ring from the hook is prevented, as well as the accidental displacement of the hook from the garment.

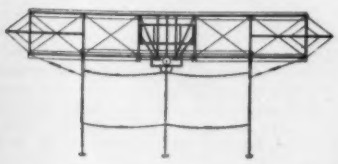
SNAP FASTENER BINDING.—O. EISENKRAMER, 461 Broome St., New York, N. Y. This closing device is in the form of a tape, carrying the closing means, ready to be attached to the edges of the undergarment where the closing means are to be provided and whereby all the closing means are secured at once. The tape carrying the closing means, further, serves as a binder for the closing edges of the garment.

COAT PAD.—I. ISAACS, care of William C. Rittenberg, Woolworth Bldg., New York, N. Y. This invention has reference to clothing and has particular reference to the making of coats. Among the objects of the invention is the provision of a pad or lining for a coat of such a nature that it maintains its shape to fit the person for an indefinite time.

PRESSURE BUTTON.—J. A. JOBON, 56 Rue Etienne Dolet, Paris, France. For the purpose of this invention the female portion of the button consists of a disk of which the peripheral part is cut out in the form of a star, the projections of which are inwardly curved so that their free ends provide between them a space of a diameter somewhat inferior to the diameter of the bulged portion of the button which is to be engaged therein under the influence of pressure.

Pertaining to Aviation.

MEANS FOR ATTACHING BOMBS FROM FLYING MACHINES TO OTHER OBJECTS.—F. A. DUGNO, 1 Union Square, New York, N. Y. This invention contemplates the attachment of a bomb to the periscope of a submarine from a flying machine passing thereover. The prin-

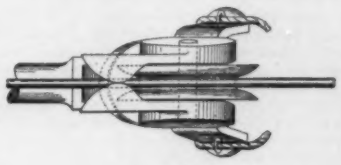


MEANS FOR ATTACHING BOMBS FROM FLYING MACHINES TO OTHER OBJECTS.

cipal features, however, are capable of application to many other uses, such as the discharging or delivering of parcels or written messages either from one flying machine to the other or from a flying machine to any other object which may be projected into or adjacent the path of the machine.

Electrical Devices.

TROLLEY POLE.—C. O. SHAUB, 116 N. Jefferson St., Dayton, Ohio. The main object of the invention is to provide a guard for preventing a trolley wheel from accidentally leaving the wire, at switches, crossovers, frogs, etc. An object is to so construct the guard as to permit its passing hangers by the spreading of its members normally held under spring ten-



TROLLEY POLE.

sion. A further object is to locate the guard below the peripheries of the wheel flanges whereby the wheel may revolve without interference over hangers, switches, crossovers, etc.; and further to provide means operable by the trolley rope for disengaging the wheel from the wire.

INSULATOR FOR HIGH VOLTAGE ELECTRIC CABLE SPLICES.—F. KLENK, 345 S. 6th Ave., Mount Vernon, N. Y. Among the objects of the invention is to provide a coupling for multiple cable conductors in which there is provided a core which is inserted between the several strands or cable, said core being of a solid nature or one which provides the maximum surface space from one cable to the next.

Of Interest to Farmers.

BEET HARVESTER.—S. MUNSON, Fowler, Colo. For the purpose of this invention, use is made of a plow for plowing up the beets and delivering the same to an elevator, which discharges onto a second elevator carrying the beets to a table, adjacent to which are located topping knives for cutting off the beet tops and a hopper for receiving the beets.

SILO DOOR.—J. H. HALL, Crossett Lumber Co., Silo Dept., Crossett, Ark. This invention relates to silo doors and silo hoops for encircling the silo between adjacent door openings. Among the objects are to provide silo doors that may be readily detached to permit the removal of the contents of the silo at a particular level, and that may be readily replaced after the level of the material is lowered; and to provide a means that will effectively and tightly hold the door in position, and which may be manipulated with facility in opening and in fastening the door.

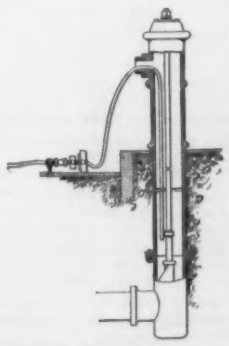
FARM GATE.—H. KIRCH, Santa Rosa, Cal. This invention improves the operating devices for farm gates by the provision of a cam mounted upon and rotatable around the vertical axis and constituting an actuator acting first to lift the gate and then to cause the gate to swing open or shut by gravitating down the incline of the cam.

FLOAT VALVE.—H. Q. SHARP, care of Martin & DeWitt, Sonora, Tex. This float valve is adapted especially for use in water tanks and other receptacles for providing water for stock or for any other purpose, wherein it is desirable to provide for a regular amount of water which is automatically renewed when a portion of the water is withdrawn.

Of General Interest.

SANITARY TOOTH CLEANER.—E. G. OVER, care of Libby, McNeill & Libby, Fort Worth, Tex. The device comprises two pockets, one formed of thin, close-mesh fabric adapted to receive the index finger, and the outer side of the other pocket is formed of an open-mesh fabric through which tooth powder readily passes. The extension of a partition beyond the pockets serves as a pull-piece and also for clamping upon the finger when the device is being used.

THAWING OUT DEVICE FOR HYDRANTS.—J. DE SIZE, 133 Hopkinson Ave., Brooklyn, N. Y., N. Y. The object of the invention is the provision of a new and improved thawing-



THAWING OUT DEVICE FOR HYDRANTS.

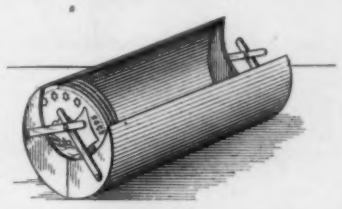
out device for hydrants, arranged to permit of conveniently connecting the device to a frozen hydrant with a view to thaw out the same with the aid of steam and to subsequently siphon the water of condensation out of the hydrants.

REEL GUIDE AND STRAP HOLDER.—P. J. FORBES, care of De Haven Mfg. Co., 50 Columbia Heights, Brooklyn, N. Y., N. Y. The guide and holder is more especially designed for use on a reel carrying a box strap roll, and arranged to insure an easy unreeling of the box strap in lengths as needed by the operator employed for putting the strap around the box and to hold the roll from opening up after the desired length is cut off.

COMBINED CLOSURE CAP AND STYPTIC HOLDER.—S. W. CAWS, Lac Ste. Anne, Alberta, Canada. The invention relates to combined closure caps and styptic holders of a kind suitable for use in connection with shaving outfits and the like, the more particular purpose being to provide a cap, serving as a closure member for a soap box or analogous container, and arranged to serve as a holder for a button or tabloid of styptic material.

HAT HOLDER FOR CHAIRS.—S. HENIGSON, 75 Division Ave., Brooklyn, N. Y., N. Y. This improvement has particular reference to an attachment to be connected to the under portion of the seat of a chair or the like for use in lunchrooms, theaters, or other analogous purposes. It provides a chair or seat, a convenient and reliable holder for the accommodation of a hat or other article while the seat is being occupied.

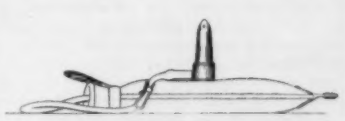
COIN RECEPTACLE.—J. D. BRADFORD, Barnesboro, Pa. This improvement refers to coin receptacles adapted to receive any required number of coins of like size and denom-



COIN RECEPTACLE.

ination. An object is to provide a receptacle which can be easily filled with coins or emptied of the same and either of which operations can be done with one hand. A further object is to provide a receptacle which exposes a portion of all the coins so that the contents of the receptacle can easily be checked and any coin of different size easily noticed. Coins can be placed in the receptacle or removed therefrom with one hand.

DETACHABLE FITTING FOR SYRINGES.—A. E. DUPELL, 752 Fulton St., Brooklyn, N. Y., N. Y. The invention relates to improvements in syringes for sanitary purposes and more particularly to a detachable fitting therefor. The primary object is to provide a device by which the several parts composing



DETACHABLE FITTING FOR SYRINGES.

the same can be readily taken apart so as to permit the cleansing thereof, the packing thereof in a compact space for transportation or the application of various styles of nozzles and particularly a cone-shaped flexible rubber nozzle.

UMBRELLA.—C. A. HARTFIEL, 179 Ten Eyck St., Williamsburg, N. Y., N. Y. The object here is to provide an umbrella frame or skeleton and any suitable number of interchangeable covers therefor, whereby a new cover may be substituted for an old, worn or damaged one, or a cover of one color or figure may be substituted for another according to the costume of a lady carrying the same.

CABINET FOR DISK RECORDS.—H. E. STEVENS, Jr., 255 W. 90th St., New York, N. Y. This invention relates to furniture and has particular reference to cabinets designed especially for holding disk records in close compact relation to one another. It provides means of a simple and reliable nature whereby the operator may select and remove any desired records from the cabinet with facility.

CIGAR HOLDER AND ASH RECEIVER.—I. SHLEPP, 1410 Pitkin Ave., Brooklyn, N. Y., N. Y. In order to accomplish the objects of this invention use is made of a receiving receptacle on which is hinged a hood provided with a perforate cover or bottom overlying the said receptacle when the hood is in closed position, and cigar rests held on the said hood and each adapted to support a cigar with the inner end, however, extending over the said perforate cover or bottom.

BOTTLE CAP.—C. R. SCHULTZ, 430 1st Ave., New York, N. Y. This invention provides means for reinforcing the body of a bottle adjacent the neck portion thereof; provides an inscription plate and means for holding the same rigidly in position on the body of a bottle; and provides a light metal cover for protecting a bottle structure adjacent the neck thereof.

PAINT.—J. H. MATTHES, care of J. Smith, 115 Broadway, Room 801, New York, N. Y. An object here is to provide a paint which under conditions to which it may be exposed is chemically and electrically passive, non-corrosive and resistant to acids, alkalis and atmospheric influences. It provides a paint for coating porous surfaces, fabrics, textiles, leather, paper compositions, etc.

METHOD FOR SAWING TAPERED LOGS.—T. RODES, Sewanee, Tenn. By this method of sawing tapered logs into boards a greater saving of lumber is obtained with a lesser manipulation of the same than hitherto. The method consists in cutting a tapered log so as to form a flattened frustocone, which is then trimmed by cutting off boards from the sloping sides parallelly to the slope of said sides.

PROCESS FOR MANUFACTURING CALCIUM SULFATE-ZINC SULFID PIGMENT.—J. L. CARPENTER, Brookville, Miss. The invention relates to the manufacture of a compound spoken of as calcium sulfate-zinc sulfid pigment, and has reference more particularly to a process of obtaining the said compound from a solution of calcium chlorid by treating the same with an alkali sulfid and an appropriate zinc salt.

SECRET BALLOT.—L. J. MOUNTS, 1210 North 21st St., Richmond, Va. The object here is to provide a ballot arranged to provide the desired secrecy as far as the voter is concerned, to prevent abstraction of the ballot from the ballot box without detection, to provide a space for the voter's name or other mark to be made by the voter, to prevent such name or mark from being read by any person unless a recount is ordered, and to allow ready collating of the ballots in series with a view to readily detect any missing ballots or surreptitiously added ballots.

RACK.—E. J. KENNEDY, 1219 23rd St., San Diego, Cal. This invention relates to racks adopted to hold articles of various kinds and classes, and one of the main objects is to provide such a device which may be quickly and easily secured in any of the number of desired places without the need of any skill or the use of any tools, screws, nails, etc.

UPHOLSTERY.—LAURA L. DODD, 112½ N. 6th St., Terre Haute, Ind. This invention relates more particularly to upholstery of an inflatable type, the object being to provide strong and durable cushion pads applicable to various uses, including the seats and backs of various articles of furniture and vehicles and also capable of utilization in the form of an independent cushion.

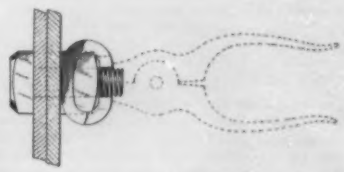
VENTILATING AND LIGHTING CONSTRUCTION.—P. SCHWICKART, 1138 DeKalb Ave., Brooklyn, N. Y., N. Y. This invention relates to walls, skylights, sidewalks, floors, roofs and other parts of buildings and other structures, and the object is to provide a construction arranged to provide an exceedingly strong and durable structure, and to permit of quickly and accurately assembling the various parts without the employment of skilled labor.

ADJUSTABLE NON-DETACHABLE TOP FOR BAGS, BASKETS, AND BARRELS.—H. A. WHITFIELD, Monroe, La. The top or cover is constructed in general conformity to the shape of the receptacle, and of such size that it is adapted for vertical adjustment therein, and it is secured detachably in place at any required height above the bottom by means of cords, straps, or equivalents, the same being secured at one end to the body of a receptacle at or near its bottom and at the other end to the top side of the top or cover.

Hardware and Tools.

COMBINATION RULE AND DRAFTING INSTRUMENT.—L. G. TUCKER, 127 South St., Detroit, Mich. The improvement provides a combination rule and drafting instrument arranged to permit of using the instrument as a protractor, square, bevel square, straight edge, compass, scale for obtaining roof pitch, rafter cuts, polygon miter cuts, elbow miter lines and scratch gage.

NUT LOCK.—B. TABKINS, L. B. 17, Moorlingsport, La. This invention relates particularly to a device to lock a nut on a longitudinally grooved bolt. The prime object is to pro-



NUT LOCK.

vide a device for the indicated purpose of simple, strong, and cheap construction, which can be readily applied in a way to hold the nut securely against turning on the bolt, while adapted to be removed with facility when desired.

EXPANSION AND FASTENING DEVICE.—G. C. RAEGER, Waterloo, N. Y. This device is especially designed for use in concrete walls, posts and other structures, and arranged to permit of conveniently placing the expansion and fastening device in a hole in the structure, locking the device therein and at the same time supporting and fastening a pipe, rod, wire, or other article securely in position.

SUCTION ROLLER.—C. P. BROWN, East Hampton, Conn. This invention relates to suction rollers for extracting moisture from paper or fabrics. The roller is inexpensive and requires little power for rotation. The suction chamber remains substantially invariable, although the rollers forming the chamber vary their relative positions.

SET SQUARE.—F. G. ALLEN, 969 Regent St., Boulder, Colo. This invention has for its object to combine in a single instrument of the drafting type a number of scales or measures, in such manner that when used in connection with a T-square, horizontal, vertical, or inclined lines may be drawn and measured at a single operation.

SAFETY RAZOR.—E. A. GUTHMAN, Bensonhurst, Brooklyn, N. Y., N. Y. The invention amplifies the available cutting edges of the safety razor; provides a holder adapted for rapid and ready adjustment of the blades to place the various cutting edges in service position; simplifies the individual blade-holders; and provides a construction, the parts whereof are readily accessible for cleaning purposes.

LATHERING IMPLEMENT.—T. G. MORGAN, care of Morgan Sales Co., Shamokin, Pa. The object in this case is to provide an implement, including a lather applying brush and a beard softening member in contiguous though independent relation and with such connections as that they may each be utilized within limits or rigidly against one another.

Heating and Lighting.

HEAT SHIELD FOR INCANDESCENT ELECTRIC LAMPS.—E. R. HOFF, 275 52nd St., Brooklyn, N. Y., N. Y. The shield is for use with incandescent lamps such as are employed in the immediate neighborhood of persons, and arranged to allow the rays of light emanating from the lamp to illuminate readily the immediate surroundings and to shield persons in the immediate neighborhood from the heat generated incident to the incandescence of the filament.

FURNACE.—W. V. JEAN, 512 University Ave., San Diego, Cal. This invention comprehends a simple form of furnace adapted to be operated by gaseous or vaporous fuel, and in which the heat is distributed as nearly equally as possible in different portions of the fire chamber, the twyers being suitably located and positioned for this purpose.

REGULATOR FOR FEED-WATER HEATERS.—J. O. THIEL, Newburg, Mo. An object of the present patent is the provision of a simple, efficient and convenient controller for feed-water heaters which is automatic in its action, and which is so arranged that any mishap will place the feed-water heater into the safety position.

Household Utilities.

EXTENSION TABLE.—H. O. SCHOLD and A. A. SWENSON, 60 Glade St., Muskegon, Mich. This invention relates to tables, as for dining-rooms, and the like, and the main object thereof is to provide such a table having self-contained reserve leaves and means for moving a desired member thereof into and out of operative position.

DOOR SPRING.—C. WIRTH, Room 404, Century Bldg., 142 Market St., Newark, N. J. The purpose in this case is to provide a door spring arranged for convenient attachment to any door and adapted to hold the door normally closed and to cause closing of the door after the same has been opened and released by a party passing through the doorway.

DOMESTIC VACUUM SEALER.—G. B. SINCLAIR and S. E. MENOUGH, Wellsville, Ohio. This invention provides a hand operated machine, including an air pump, a vacuum hood connected with the pump by a flexible tube, an adjustable stem carrying the hood, and means to control the various positions of the stem and parts associated therewith, and whereby a quick and easy operation is obtained.

CONVERTIBLE AND FOLDING COUCH AND CHAIR.—J. LUPPINO, 445 55th St., Brooklyn, N. Y., N. Y. The object of this invention is to provide a convertible and folding couch and chair arranged to permit of conveniently converting the couch into a chair or *vice versa*, or folding the same to form a comparatively small bundle for ready storing or transporting purposes.

FLY SWATTER.—F. E. KENDRICK, 609 Walnut St., Easton, Pa. This invention relates to the extermination of insects, such as flies, mosquitoes, and the like, and the main object thereof is to provide one device adapted for use as a manually operable swatter on low levels and also for use upon ceilings of rooms, the handle rod being made extensible and collapsible in order to adapt the device to such uses.

SHAMPOO SPRAY.—A. A. STAAB, 3 Hooper St., Glendale, L. I., N. Y. Among the objects of the invention is to provide a shampoo or spraying device for connection with the hot and cold water spigots of a sink or lavatory for the purpose of shampooing the head, special attachment means being provided to carry out this general purpose.

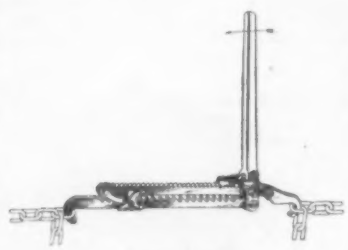
Machines and Mechanical Devices.

AUTOMATIC DRIVING LOAD CONTROL.—A. W. WARREN, 1440 E. 15th St., Brooklyn, N. Y., N. Y. This invention relates to power transmission means, and has reference more particularly to coupling means connecting the driven and driving member, whereby an increase in load on the driven member is prevented by an automatic uncoupling of said driven and driving means.

BUTTON MAGAZINE AND FEEDING DEVICE.—B. KOTKOVSKY, 172 Lorimer St., Brooklyn, N. Y., N. Y. A specific object of the invention is the provision of a new form of button-feeding chute or raceway provided with means for effecting the discharge of buttons one at a time therefrom to the staple-forming and attaching mechanism, such means and chute being so designed as to be adapted for use with buttons of different sizes.

POTTERY MACHINE.—F. G. HANEY, 915 W. 8th St., East Liverpool, Ohio. This improvement has reference to potteries, and the object thereof is to provide a machine for performing the operation of "batting out" and "balling," now done by hand, to get the clay in shape for the "jiggerman" in the formation of ware, such as plates, saucers, cups, bowls, etc.

CHAIN CLAMP.—C. F. SMITH and J. ROBERTSON, Dutchess Junction, N. Y. This invention relates to hand operated implements, and has reference to a lever operated device for drawing together parts of a chain for con-



CHAIN CLAMP.

necting them or for operating upon wires, cable or other parts which are to be drawn toward each other forcibly. It simplifies and improves the class of devices described and claimed in Messrs. Smith and Robertson's previous patent, No. 1,051,771. The engraving shows the application of the implement to separated ends of a chain.

PULLEY AND DRIVING BELT GUARD.—J. J. SWEENEY, 117 W. 79th St., New York, N. Y. In the present patent the invention has reference to guards for pulley and belt driving means for power presses and the like, wherein the power is obtained from an overhead shaft and the machine is adjustable with respect to such overhead shaft.

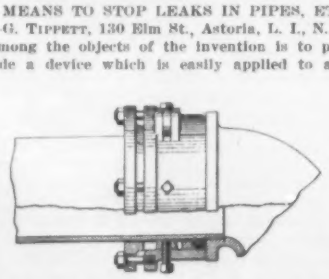
JIG.—J. C. AMIS, Toms Creek, Va. This invention pertains to jigs, adapted for use in the separation of base materials from mixtures as originally mined, such as slate from coal, and the main object thereof is to accomplish this result at any desired specific gravity, regardless of the per cent of heavy or light materials, automatically.

UNIVERSAL STONEWORKING MACHINE.—O. BAUER, 35 Bay 32nd St., Brooklyn, N. Y., N. Y. This invention has reference to machines used by lapidaries or stone workers, and has particular reference to machines for grinding irregular surfaces in a precise and uniform manner irrespective of the number of pieces to be made or finished.

PRINTING PRESS.—J. M. TRIER, 1022 Jackson Ave., Bronx, N. Y., N. Y. The improvement provides a continuously acting, multicolor printing press having a variety of printing beds, and means for automatically feeding ink to said beds; increases the life of the press; economizes space occupied by the press; reduces the necessary power for driving the press; and provides rapid means for supplying the press with ink.

DISTRIBUTING CHUTE.—O. E. WEST, Box 87, Brunswick, Ga. The purpose of this device is to enable the material to be fed through the chute with a considerable degree of freedom, the chute and mechanism immediately associated therewith and practically constituting a part of the same taking care of the material as it passes through the chute.

MEANS TO STOP LEAKS IN PIPES, ETC.—G. TIPPETT, 130 Elm St., Astoria, L. I., N. Y. Among the objects of the invention is to provide a device which is easily applied to any



MEANS FOR STOPPING LEAKS IN PIPES, ETC.

leaky joint and which serves to seal the leak most effectively, means being provided of a peculiar nature, whereby through the loosening of a single bolt nut, the entire device may be slipped from the pipe or fitting after it will have served its purpose in stopping the leak.

PHOTOGRAPHIC CAMERA.—A. VORIS, 252 W. 43rd St., New York, N. Y. This invention relates more particularly to the means for focusing the image on a screen disposed in the plane of the sensitive surface. A further object is to provide a means whereby a visual image on the focusing screen may be erected and magnified, or reduced so as to get a more brilliant image of smaller proportions.

SAW GRINDING MACHINE.—E. E. HENRY, care Twillinger Flats, Bond St., Astoria, Ore. The improvement provides a structure which may be used for grinding or sharpening various kinds of saws. It also provides a grinding device which by a back and forth movement will feed the grinding device forward so that the same may be brought successively into engagement with the respective teeth of the saw.

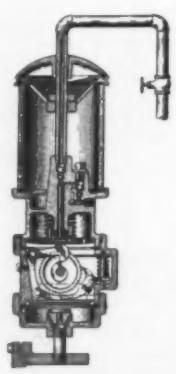
HYDRANT.—G. N. FRAZER, care of Eugene Iron Works, Eugene, Ore. A casing is provided having a main inlet valve at one end, capable of being closed by a valve mounted to swing into and out of closed position, and wherein the valve is connected to its operating mechanism by hollow trunnions, arranged to permit the casing to be drained of all water that may be therein when the valve is closed, and wherein the opening of the valve will move the bore of the trunnions out of register with the drain port to close the same to prevent leakage.

Prime Movers and Their Accessories.

DRIFTING VALVE.—A. ROSS, 655 Jersey Ave., Jersey City, N. J. The invention avoids sudden cooling of the cylinders when the steam is cut off; avoids overheating or dry-heating of the cylinders; lubricates the cylinder during the period in which the engine is running on its momentum; provides for automatically supplying steam to the cylinders to accomplish the above-stated objects, when the power steam is cut off; and provides for suspending the operation of the mechanism when the engine is brought to a standstill.

INTERNAL COMBUSTION TURBINE.—P. H. HOLTZ, care of Faultless Caster Co., Evansville, Ind. The primary object here is the production of a rotary internal combustion engine which instead of employing gas, which is compressed and ignited or which employs steam to derive kinetic energy, employs an explosive matter or element designed to be exploded by friction or otherwise when fed into the machine so as to result in the generation of gases designed to exert energy for driving the rotor of the machine.

LUBRICATOR.—W. W. KNIGHT, Birmingham, Ala. This invention is an improvement in lubricators, and has for its object to provide a lubricator adapted for positively feeding lubricant from a suitable container to a



LUBRICATOR.

surface to be lubricated, and designed for connection with the cylinder of an engine, either steam or liquid fuel, and wherein the feeding mechanism is arranged to be operated by the variations in pressure in the said cylinder.

RELIEF VALVE.—J. A. BUTCHER, York, Pa. The inventor provides a delicate and single seat valve for use with boiler feed pumps to prevent over feeding, which will operate at a predetermined pressure without any possibility of sticking or the like. He provides a valve all of whose parts are easily accessible and removable.

Railways and Their Accessories.

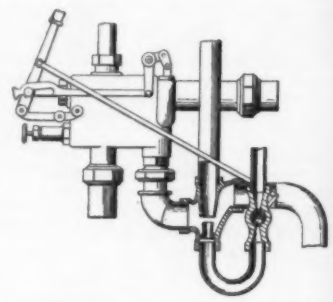
GUARD RAIL FOR BRIDGES AND LIKE STRUCTURES.—T. J. CARTER, 401 7th Ave., S. E., Roanoke, Va. The invention relates more particularly to the guard rails used upon bridges and like structures, the object being to provide an inexpensive guard rail which will present a great advantage in durability over the wooden beams now employed as guard rails and which will serve to form a convenient and secure connection for certain elements adapted to extend between the track ties and effectively space the same apart.

CAR STEP.—C. MCKAY, Maple Lake, Minn. By means of this invention the box step in use at present with passenger cars of railways can be dispensed with. The invention provides an efficient device whereby a safer ascent to and descent from a car can be obtained, and thereby accidents diminished.

LADDER MAKING MACHINE.—F. A. STICH, 305 Castleton Ave., Mount Vernon, Ill. This invention relates to a machine for manufacturing ladders, particularly those used upon railway cars, and the main object thereof is to provide such a machine whereby a rung or round is shouldered and riveted in the two side stringers in one operation and with but one heating of the said round.

LOCOMOTIVE ENGINE CUT OUT VALVE.—S. A. DUGAN, 2315 Avenue F, Galveston, Tex. This invention has reference to locomotives and deals more especially with valves for cutting out either engine of the locomotive under certain emergency conditions whereby the locomotive can still be run to a point of repair or to the end of the route.

LOCOMOTIVE INJECTOR ATTACHMENT.—C. R. HEATH, Box 544, Cashmere, Wash. In ordinary practice the overflow from locomotive boiler injectors is discharged alongside and near the railroad tracks. In cold weather this overflow freezes, forming coatings of ice near the tracks in railroad yards, resulting



LOCOMOTIVE INJECTOR ATTACHMENT.

oftentimes in very serious accidents to the railroad employees which are a constant source of trouble and expense to remove. This invention overcomes these difficulties by providing means for returning the overflow water back to the boiler feed system, thus preventing the promiscuous discharge of the overflow alongside the tracks.

RAILROAD TIE.—C. C. LEWIS, 216 Conover St., Burlington, N. J. The invention refers more particularly to a tie comprising a casing filled with ballast. An object is to provide

RAILROAD TIE.

a strong and inexpensive tie which has detachable rail attaching means whereby rails can be easily and quickly replaced, and which attaching means will prevent lateral displacement of the rails on the tie.

RAIL JOINT.—J. D. MCCALL, McCall, Idaho. One of the principal objects of the invention is to provide a rail joint of the continuous rail type, of such nature that the rails are readily interchangeable and the ends of the rails so fashioned that low joints and spreading rail ends are eliminated.

RAIL BRACE.—J. H. BATTEN, 2001 Laura Ave., Wichita, Kan. The invention provides a brace which will effectively prevent creeping or spreading of the rails of a track, thus minimizing the danger of derailment of a car or train. It provides a rail brace for accomplish-

RAIL BRACE.

ing the above result, which comprises a pair of clamping members, one of which is movable laterally and longitudinally relative to the other, whereby the brace may be detached from the rail.

Pertaining to Recreation.

BOWLING BALL RETURNWAY.—E. SCHLOSSBERG, 1007 Metropolitan Ave., Brooklyn, N. Y., N. Y. In the present invention the improvement has reference to the provision of a ball returnway in which the balls are delivered onto a rack located at the front of the alley over and at the ball terminal. Balls of different diameter can be directed on to the rack.

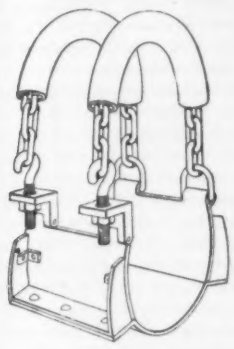
GAME APPARATUS.—H. E. MAHONEY, 212½ Magnolia Ave., Tampa, Fla. This invention provides a game apparatus with jointed figures pivoted at their feet and having depending rods by which they may be extended periodically, the rods being normally disposed in guideways which have openings through which the rods may move to permit the figures to fall when the rods and the figures are raised to pre-determined positions.

ANIMATED TOY.—A. GUND, 220 W. 19th St., New York, N. Y. In the present patent the invention relates to spring motor actuated toys, and the object is to provide a new and improved toy, preferably simulating a human

being or an animal, and arranged to creep or walk along a floor, table or other support.

Pertaining to Vehicles.

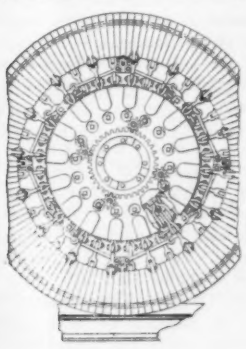
TIRE SHOE.—J. C. McCALL, 1535 Pruitt St., Fort Worth, Tex. This invention has particular reference to means to prevent the slipping of pneumatic tired wheels in snow, ice, mud, sand or the like. It provides a device adapted to be easily applied to a pneumatic



TIRE SHOE.

tired wheel, in sufficient quantities or number, to make a covering for as much of the periphery of the tire as may be required in any particular case. In the event of a blowout or puncture, the tire shoe may be employed to protect or temporarily heal the damaged tire.

SPRING WHEEL.—G. J. MURPHY, F. C. C. A., Baradero, Buenos Aires, Argentina. The invention provides a spring wheel employing resilient spokes and resilient stays, and means for varying the tension of the spokes and

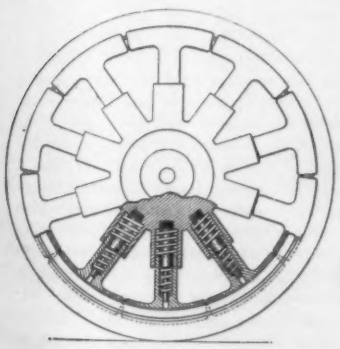


SPRING WHEEL.

stays; provides a spring wheel in which the resilient elements are so arranged that the shock will be absorbed throughout the entire wheel; and provides a wheel, certain features of which are particularly adapted to reduce wear and tear on the railway track and rolling stock.

WIND SHIELD.—J. L. STRICKLER, 1276 S. Pearl St., Denver, Colo. The shield is adapted to deflect the wind above and to each side of the occupants of the automobile, as well as deflecting dust and flying particles of matter, and one of the main objects is to remove the glass usually employed in such shields away from the zone of danger to the automobile occupants in the event of sudden stoppages, as in collisions and the like.

SPRING TELESCOPIC SPOKE WHEEL.—M. P. LAVERY, 334 Degraw St., Brooklyn, N. Y., N. Y. The invention provides a spring telescopic spoke wheel on which the rim is made



SPRING TELESCOPIC SPOKE WHEEL.

up of a series of sections formed with or carried by the movable part of a spoke, each spoke embodying telescoping sections with interposed spring or cushioning means for taking up shock and vibration, while means are provided to encircle the rim sections to equally distribute the compression upon the resilient or spring means around the wheel as the latter rotates under a load.

DETACHABLE TIRE.—L. B. BERNHEIM, 126 W. Main St., Louisville, Ky. This tire is of the type in which the shoe with the inner tube inflated can be applied to the felly of the wheel without a demountable rim structure being required to hold the tire in its inflated condition, the advantage being that extra inflated tires may be carried on a car without the necessity of employing demountable rims for each tire.

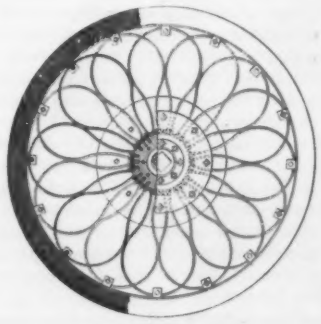
AXLE.—W. E. WISE, 421 Rural Ave., Williamsport, Pa. This improvement relates to a vehicle axle of the type formed in sections, and adapted to be extended or contracted. It is more particularly designed for use on the combination sleigh and wheeled vehicle forming the subject of an application for patent filed by Mr. Wise, Serial No. 809,234, in which sled runners are adapted to be lowered from a raised position beneath the vehicle wheels when it is desired to convert the vehicle into a sleigh.

SLACK ADJUSTER.—H. ROSE, "Yonka," Holt St., Stanmore, New South Wales, Australia. The "slack" of brakes is the amount of play between the brake shoes and the wheel tires when the former are hanging free, and as the shoes wear away by friction the amount of slack increases and the movement of the pull-rod and links required to bring the shoes into contact with the tires increases proportionately to the wear. This invention provides a more simple and positive yet equally efficient slack adjuster involving the use of a ratchet wheel but not employing screw gear.

SIGNALING DEVICE.—A. STERN, 68 Highland Ave., Yonkers, N. Y., and P. K. STERN, deceased. This invention has reference more particularly to signaling systems for vehicles. It provides a signaling system whereby the anticipated movements of the vehicles are announciated by the party controlling the course of the vehicle, thus promoting the safety of the vehicle against accidental collision in traffic, therefore making traffic safer.

HEADLIGHT CONTROL.—G. W. ATKINSON, Iron Bldg., 17 and Arapahoe Sts., Denver, Colo. The main purpose in this case is to provide means whereby the headlights may be deflected from the normal "deadhead" position in any desired direction in order to enable a driver to see to either side of the road, and at various heights.

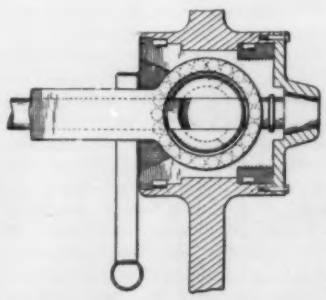
SPRING WHEEL.—H. F. C. RIETSCHEL, 895 Union St., Brooklyn, N. Y., N. Y. This invention relates to carriages and wagons and has particular reference to vehicle wheels. It provides a resilient wheel comprising a plurality of metallic springs and also having a flexible



SPRING WHEEL.

rim for the purpose of dispensing with the usual pneumatic tires now commonly used on automobiles and other vehicles. It also provides an easily applied emergency repair device should one or more of the springs become broken while on the road.

DRIVING MECHANISM FOR AUTOMOBILES AND LIKE VEHICLES.—J. M. LULL, Wausau, Wis. In this case the object is to provide a mechanism for connecting the front wheels of the vehicle to the axle in such manner that while the wheels may move with re-



DRIVING MECHANISM FOR AUTOMOBILES AND LIKE VEHICLES.

spect to the axle to guide the vehicle, they will yet be constrained to rotate with the axle to permit the four wheels of the vehicle to be driven from the motor.

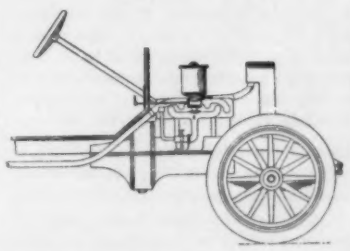
COMPRESSOR FOR DEMOUNTABLE RIMS.—H. E. LEE, Grandview, Ohio. The invention provides the use of a lever whereby to separate the meeting ends of the demountable rim and draw the separated ends into overlapped position, thereby compressing or constricting the rim. In connection with the clamp elements to be engaged by the lever latch means effect latched engagement between the elements when the rim is compressed, whereby to hold the latter against the tendency to expand to its normal form.

SPRING WHEEL.—T. S. THOMPSON, Belfast, Maine. This invention is embodied in the form, arrangement, and attachment of flat springs which are interposed between and bolted to the inner wheel rim and the outer metal tire constituting the tread. The wheel com-

SPRING WHEEL.

prises an inner rim and concentric tire, and a series of flat, steel springs attached to and connecting them, said springs having adjoining outward and inward bends contiguous to their rim ends, the remaining portion of the springs being practically straight and arranged tangentially to the rim.

LUBRICATOR.—S. P. WOOLF, 3024 Ames Ave., Omaha, Neb. This inventor provides a lubricating device for supplying a non-combustible lubricant to an internal combustion engine such as that used on automobiles. The device



LUBRICATOR FOR AN INTERNAL COMBUSTION ENGINE.

may be operated from the dashboard of an automobile or similar vehicle, and will deliver a measured quantity of the lubricant into the interior of the intake manifold. The device regulates the amount of lubricant thus delivered.

FORM FOR FRONT AND REAR OF AUTOMOBILE TOPS.—A. H. STOKES, 654 Third Ave., Detroit, Mich. The essential object here is evolved by the provision of shaping devices constructed of sheet material, such as very thin metal, shaped to cause the front and rear portions of a vehicle top to take a rounding shape whereby a very desirable style and appearance is produced, as well as providing means permitting reinforcement of the hood of the top at these particular points.

SAFETY BRAKE FOR AUTOMOBILES.—G. W. YANNEY, 756 S. Seneca Ave., Alliance, Ohio. The invention is designed for embodiment in automobiles to prevent the car from running backward in case of failure to apply the ordinary brake. When the car is left standing on a grade it can be started from a standstill instead of requiring to be started against any rearward momentum that the car may gain when the ordinary brake is released.

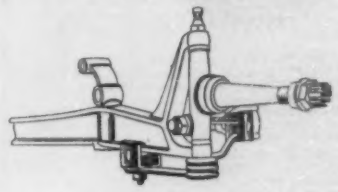
PRESSURE DROP ALARM FOR TIRES.—F. P. FREEMAN, Richland, Wash. In the present invention the improvement has reference to an indicator or alarm for use in connection with vehicles having pneumatic tires whereby the pressure drop in any tire will be immediately indicated, as well as the location of the particular tire.

WEATHERPROOF ANNUNCIATOR CASE.—A. STERN and P. K. STERN, 68 Highland Ave., Yonkers, N. Y. This invention relates to cases for annunciators of the electrical type and has reference more particularly to cases for annunciators for signaling the anticipated movement of a motor vehicle. This weatherproof case can be quickly and easily assembled or taken apart without in any way injuring the weatherproof qualities of the case.

CONTROLLER.—A. STERN, 68 Highland Ave., Yonkers, N. Y. The present invention has reference to controllers for electric circuits, and has reference more particularly to a device of the make-and-break circuit type. The device is intended for use in connection with annunciators to be carried by self-propelling vehicles.

FOLDING BACK.—H. W. WEED, 21 4th St., Stamford, Conn. The invention provides a folding back for motor cycles, bicycles and like machines and devices, and is arranged to enable the rider to readily swing the back into approximately horizontal position for mounting and dismounting purposes, and to permit the rider to swing into upright supporting position, after having mounted, to support the back of the rider while using the machine.

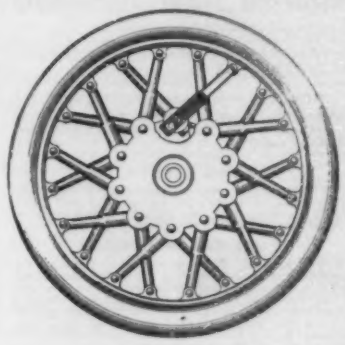
CASTER SPRING.—C. A. MILLER, Spring Valley, Ill. This invention provides a spring especially adapted for use with light motor vehicles and to be arranged between the front axle and the steering knuckle arms, for nor-



CASTER SPRING.

mally holding the arms in normal position with respect to the axle in order to produce a caster effect on the steering wheels on the vehicle to cause the wheels to tend to travel in a straight line with the rear wheels.

VEHICLE WHEEL.—F. V. UBERTI, 183 Thompson St., New York, N. Y. The inventor provides a wheel having two series of yielding, supporting spokes, said series being disposed in outwardly-converged frusto-conical planes; provides supporting spokes adapted to yield in



VEHICLE WHEEL.

lines parallel with the central plane of the wheel, said spokes having bearing ends disposed in lines inclined to said plane to resist the side thrust of said wheel; and the invention simplifies the construction of a wheel of this character.

TRUCK.—I. MCCOON, Windsor Locks, Conn. The invention is an improvement over Mr. McCoon's Patent, No. 1,103,796, issued July 15th, 1914. It provides a simple, inexpensive, strong and convenient manually operated truck, in which the platform for loads is made to move bodily and in which the platform can be maintained in its extreme position without any effort.

HOOD FOR MOTOR BUSES AND OTHER VEHICLES.—H. ADLER, 32 Second Ave., Melville, Johannesburg, South Africa. The invention provides means which may be readily and rapidly manipulated for the purpose of protecting the upper part of motor buses and other vehicles or the passengers upon the same when required, while the devices, according to the invention, are such that they may be readily collapsed or folded or hidden away so as not to render the vehicle unsightly in appearance or difficult to handle when the hood or covering is not required in operation.

Designs.

DESIGN FOR A BOTTLE.—J. F. O'CONNOR, 113 W. Broadway, New York, N. Y. In this ornamental design the side elevation shows a bottle of slim and graceful appearance, the body between the neck and base being of a strikingly original outline.

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Notes for Inventors

The Base Ball Machine.—A patent has issued to Edward M. Harberson, of Los Angeles, Calif., No. 1,144,472, for a so-called base ball machine. The object is to make the game mechanical. The machine includes an air gun which throws the ball and to which balls are fed one at a time. An imitation pitcher is arranged to operate in unison with the air gun. At the mouth of the gun there is a curver for curving the ball. This curver and the other parts of the machine are under the control of the operator, except the batter, who stands in the usual place and tries to strike the balls as they are fired from the gun. As to whether this machine will dispense with the high-priced pitchers is something that remains to be seen. It may be found useful in batting practice.

Improvement in Submarine Warfare.—In a patent No. 1,131,761 G. H. Wheaton, administratrix of C. M. Wheaton, deceased, of Newton, Mass., assignor to J. Colby Bassett of Boston, Mass., has secured a device relating to submarine warfare in which a submarine vessel is provided with a pin or projectile which is driven upwardly through the bottom of a ship and an anesthetic gas is subsequently injected through the hollow bore of the projectile, which is made tubular for such purpose, in order to overcome the crew of the ship. The patent also contemplates as an alternative the mode of attack or attachment of a time bomb to the projectile leaving the bomb to explode after the submarine vessel has removed to a safe distance.

A German Expanded Metal Basket.—Jreham Rizzardi of Cassel, Germany, has a method of manufacturing metal baskets by pressing or expanding into the desired shape a suitably cut metal plate. It is described in detail in patent No. 1,144,668.

Another Novel Golf Tee.—A golf tee of rubber with an anchoring device which gives it sufficient weight to hold it in place on the ground, the whole being made out of resilient rubber so that it can be easily folded to be carried in the pocket, has been patented to Hamilton Albert of Passaic, N. J., assignor to the Manhattan Rubber Mfg. Company of same place No. 1,144,747.

Paper Feeders for Typewriters and Adding Machines.—Patent to E. J. Barker No. 1,140,493 is for an improvement in supplying paper from a roll or rolls to the platen of the machine and avoids the tendency of such feeding to resist the rotation of the platen and the lateral movement of the carriage and keeps the paper in proper register by maintaining a hanging slack portion of the fed paper between the supply roller and the machine.

A Camera Range Finder.—Radcliff A. Wilson of San Francisco, Calif., in a patent (No. 1,144,675) describes a distance measuring device by which the distance of an object from the observer can be obtained to enable a camera user to focus accurately a distance finder, in the use of which the camera user sights at a point as near as possible on the level with his feet at the base of the object. The average height of persons gives a base line for the determination of the measurement. A pendulum moving across the distance scale aids in securing the distance. The pendulum is attached to the side of the camera.

Makes a Sanitary Cigar End.—With a view to avoiding the unsanitary mouth moistening of the fingers by cigar makers, W. F. Ligety of New York city, has patented No. 1,141,399, a cigar in which the wrapper is applied to the "bunch" and has a portion extended beyond the end of its body portion and twisted to form a strand which is coiled about the end of the cigar with its end tucked underneath the adjacent convolution, so that the end of the cigar is retained in position and protectively reinforced without the use of a paste. Hence there will be no necessity for the cigar maker to moisten his fingers.

Special Sight Device for Viewing Moving Pictures.—H. F. Stowell of Rochester, New York, has patented No. 1,141,432, an optical device in the form of eyeglasses or of lorgnettes wherein the eye pieces are of black paper or other opaque material and are provided with restricted slits which aid in cutting off most of the excess or marginal rays and prevent the strain upon the eye incident to the flickering effects common to moving pictures, means being provided for adjusting the size of the slits both as to length and width.

Flying Machine for Heavy Passenger Traffic.—A St. Louis man, Frank Steinmann, has patented a flying machine, No. 1,141,431, which is adapted for use on an elevated monorail for heavy passenger traffic or for amusement purposes, as well as for flying and the machine includes a number of elongated air tanks which support a frame structure and contain compressed air, from a suitable compressor, which is conducted under suitable control to operate a pair of tiltable stabilizing propellers arranged at the lateral edges of the stabilizing plane.

Making and Filling a Bag at One Operation.—In patent No. 1,143,801, to Adelmer M. Bates of Chicago, Ill., assignor to Bates Valve Bag Company, of same place, is described a process for bag making. A strip of paper is drawn from a roll and a side sewing machine seams the edges together to form a tube. One end of the tube is sealed, then the tube reversed and filled according to the quantities desired to bag. A gum or other sealing material closes the other end of the bag. The bag is then cut off so that the tube is formed, filled, made into bags and the bags separated at the one operation.

Safety First and Last for the Canoe.—Attempts have been made to secure the passage of police regulations limiting or prohibiting the use of canoes in view of the danger involved. Life saving devices in connection with canoes offer unusual difficulties because it is impracticable for the canoist to wear a preserver owing to its interference with his freedom of movements as well as the unsightly appearance. If life preservers be supplied to the canoe inboard, they will in case of turning over be held beneath the overturned canoe, while if arranged outboard they interfere with the propulsion. Possibly some means may be provided for rendering canoeing safer and life preservers may be provided inboard and arranged to come out in case of overturning, or other suitable safety devices may be devised either in the construction of the canoes themselves or in separately applied appliances, the problem being one that should attract the attention because of the demand especially at this time of the year.

Farm Machinery Trade Associations and Patent Licenses.—In an interesting report on Farm-machinery Trade Associations made by the Bureau of Corporations to the Department of Commerce, an extended consideration is given to the history of the wind-stacker patents license system. It appears from the report that the first commercially successful device to carry away the straw and dust from a threshing machine separator by means of an air blast, was invented in the latter eighties by James Buchanan, of Indianapolis, Ind., who organized a company for the manufacture of the stacker, which company became financially embarrassed and developed into another company or companies which proceeded to manufacture stackers and sell them already applied to separators, subsequently extending to other manufacturers licenses containing the usual features of license contracts. These licenses also contained certain price restrictions and the manufacturing and threshing companies subsequently got into a controversy with another company. The report altogether is an interesting account of the successes and vicissitudes of a company operating under a patent and developing by the purchasing of many other patents in an effort to control the field and avoid expensive litigation resulting from suits by other patent owners. It offers an interesting object lesson and one containing much instructive matter to patentees contemplating a similar exploitation of their improvements. The report in its entirety is published in the Department of Commerce Bulletin above referred to and doubtless will be found of much interest to those especially concerned in this form of commercial enterprise.

Trademark Notes

Trademark Decision.—In a recent case, Simplex Electric Heating Company, Appellant v. Gold Car Heating and Lighting Company, Appellee, the Court of Appeals of the District of Columbia reversed the decision of the Commissioner of Patents and sustained the opposition. The Court held that while it appeared that Appellee company only used the mark on its thermostatic steam trap used in connection with its steam car heating apparatus it must be considered that the granting of a registration would authorize it to extend its use to any thermostatic steam trap. It further held that it was no answer that the appellant had not manufactured a steam car heating system upon which thermostatic steam traps were used or even that its trade-mark had not been applied directly to the thermostatic devices in use; they were a part of its system and it is at any time within their power to apply it to any appliance of that kind that they may manufacture and Justice Van Orsdel in delivering the opinion said, "Appellee should not, in justice, be permitted by the adoption and use of this mark, to invade the present field of appellant, or the domain to which it may legitimately extend the use of its mark."

Trademark Decisions.—The Court of Appeals of the District of Columbia, in Heaton-Peninsular Button Fastener Company v. Independent Button Fastener Company, has sustained an application for cancelation of a mark registered under the ten-clause of the Trademark Act and consisting of an accurate illustration of an article patented February 10th, 1891. In the course of the decision the Court said, "the representation of a staple could not constitute a technical trademark as it is peculiarly descriptive of the article" and that upon expiration of the patent the right to manufacture the article passes to the public and the monopoly cannot be prolonged by the claims of a trademark descriptive of the article.

The same Court in Kaiserbrauerei Beck & Co. v. S. Liebmann's Sons Brewing Company held the marks "Imperator" and "Kaiser" not to be so similar as to be likely to cause confusion in the trade.

The Court of Appeals has also held in the case of Alaska Packers' Association v. Admiralty Trading Company that where the opposer has itself used several different flags in the sale of several different brands of its goods and the flag used by the applicant differs from each of the flags used by the opposer as much as they differ from one another, that the opposer is not in a position to contend that the mark of the applicant will be likely to cause confusion in trade and that the opposition was properly dismissed.

Trademark "Quaker" Not Same as "Quaker City."—The Court of Appeals of the District of Columbia in Quaker City Flour Mills Company v. The Quaker Oats Company, Quaker Mills Company, American Cereal Company, has held that where the applicant has used only the marks "Quaker City Mills" and "Quaker City," it has no right to register the word "Quaker" as the law requires that the mark sought to be registered must be the same as the mark shown to have been used, and in the course of the decision the court quotes the decision of Justice Robb *in re* Motz Tire & Rubber Co.; wherein he says in part, "the applicant now seeks to register a mark which the records fails to show it has ever used. The Patent Office was therefore quite right in declining to register this fictitious mark, this mere skeleton of the real mark." It also quotes the decision of the Commissioner of Patents in the present case as pertinently observing "The word 'Quaker' and the words 'Quaker City' have different meanings. The use of 'Quaker City' on goods does not establish trademark use of the word 'Quaker' any more than it establishes trademark use of the word 'City.'"

False Representation by Trademark User.—In Channell Chemical Company v. E. W. Hayden Company, it has been held that the maker of an article who makes false representation to the public in respect to it in his advertisements, has no standing in equity to maintain a suit to protect a trademark under which it is sold.

The First Year of the Great War

(*Concluded from page 111.*)

hundred and fifty mile gap to Paris. Time and again the greatly outnumbered French and British valiantly took defeat in their effort to hold back the German tide long enough to permit of a readjustment of the French forces before the German gate had swung shut on Paris. The battles of Cambrai, St. Quentin, Guise, Launois, Le Fere, Amiens and Rheims were but milestones along the road of Germany's triumphal march, which was not halted until September 7th, when the Germans were across the Marne and extended on an east and west line from Verdun to Paris.

Throughout this disastrous campaign the French people kept their self-control and supported their commander, who was gathering together his forces for the battle that was to decide the fate of the French army. The government was removed to Bordeaux and Paris prepared for siege, and still the French wisely refused to accept a decisive battle before the scales indicated that the weight of numbers and the advantage of position had shifted in their favor. The victories of Russia in the east compelled Germany to send troops from France to the eastern theater, and Belgian attacks from Antwerp were drawing additional forces from the fighting line to protect the long line of communications. On the other hand, France was collecting every available soldier and England was rushing her troops to the Continent. Finally, on September 6, the day had arrived for the supreme blow of the French army, and the battle of the Marne was begun.

The First German Reverses.

From Paris on that day the garrison of the city and the British army fell upon the exposed right flank of the German army, but five miles away, and almost completely enveloped it. Still the Germans did not give up all hope of delivering the final blow which would give their great drive on Paris a successful ending, and to the east of Paris they concentrated for a powerful assault on the French center. Their failure here and the threatened disaster to their flank completely turned the tables, and by September 10th the German host was retreating precipitately over the same roads they had used in their triumphal advance only a few days before.

The French had tasted victory and their pursuit was spurred on by the hope of destroying the entire right wing of the invading army, but the Germans were able with desperate fighting to rally behind the Aisne River. This was September 12th, the day that marked the beginning of the battle of the Aisne, the most desperate struggle up to then in the war. For days the battle continued, but in the end the Germans had rearranged their lines and were in strong possession of their position, and it became evident that France was not to be freed of the invader.

During this trying period for Germany, the Belgian army that had fallen back to the north of Antwerp when Brussels was captured in August, became such an annoyance in the German rear, that the capture of Antwerp was undertaken. With incredible swiftness the Germans carried out this operation against a fortress supposedly strong enough to withstand a siege of many weeks. The siege was begun September 28th and Antwerp fell ten days later, but the bulk of the Belgian army made good its escape to the west and robbed the Germans of the choice fruit of their victory.

Then began the series of desperate struggles on the northern wing of the long battle line in which the two armies vainly tried to outflank each other and gain a decisive success. The most important of these was the fighting about La Bassee and Ypres in the last half of October, the battle of the Yser in the last week of the same month, and the battle of Ypres in the first half of November. Back and forth flowed the tide of battle without either side gaining any decisive advantage. The battle lines were gradually extended until their flanks rested on the sea, and with this barrier against enveloping movements in the north and Switzerland barring similar operations in the south, the opposing forces settled down to the indecisive although oftentimes desperate trench warfare that characterized the fighting on the western front throughout the winter and until the present time. Both sides occupy to-day practically the same positions they held at the beginning of this calendar year.

The Early Russian Successes.

Throughout the early weeks of the war the operations in the west were of such magnitude that the less stirring events in the eastern theater attracted minor attention. Russia's mobilization progressed more speedily than was expected, and early in the war she checked Austria's attempt to carry the war into Russian territory, laid secure hold on the initiative, and, so far as Austria was concerned, held it for many months. Russia was confronted by weak German forces on her German border and by the bulk of the Austrian army farther south. Her plan for a time was to play a minor rôle against Germany, while concentrating overwhelming numbers against Austria. If she succeeded in destroying the Austrian army, she would turn her full strength against Germany. She was compelled by the success of Germanys' drive into France to come to the assistance of her western allies by a more vigorous campaign against Germany than she had originally planned. About the middle of August she began her advance into East Prussia and found little difficulty in pushing back the weak German forces in her front. By August 24th the great fortress of Koenigsberg had been passed by and isolated, and two days later Allenstein was occupied. It began to look as if her victorious march would not be stopped short of the fortified line of the Vistula River. But Germany sent from the west two corps she could ill spare from her campaign against Paris, and on September 1st they gained, at Tannenburg, the first of many brilliant victories to be won by German arms in East Prussia. Two Russian army corps were all but destroyed and the rout was so complete that Russia did not recover until after she was driven from East Prussia in the middle of September. Still the campaign was not barren of results for the Allies, for it had subtracted two corps from the German army in France at a critical stage of its operations.

In the southern portion of the Russian theater, Austria began her advance through Galicia toward Russia as soon as she had completed her mobilization. The left wing of her army advanced between the Vistula and Bug Rivers into Russian territory and won the battle of Krasnik on August 28th, but the victory was nullified by the severe defeat of the center before Lemberg two days later. Still, two days later the right wing from the Carpathians to the Dniester River was driven back and the fortress of Halicz was taken. The disaster was made complete by two more victories at Rawa Ruska and Tomaszov over portions of the Austrian army that were trying to escape. The retreat became practically a rout and another stand was not made until the fleeing army had reached the line of the San River, seventy miles west of Lemberg. This position naturally secure, received additional strength from the two fortresses of Jaroslav and Przemysl. By September 16th they were in this position, but were able to hold it only a few days. North and south of Przemysl the Russians crossed the San, surrounded and laid siege to that fortress, captured Jaroslav, and once more put the Austrians to flight. This time the defeated army continued its march to the rear for eighty miles until it reached the line of the Dunajec River but fifty miles east of Cracow, an important strategic point on the western border of Galicia. The Austrian defense was crumbling away and help must come from somewhere. Once more Germany had to jeopardize her campaign in the west to meet the oncoming Russian horde in the east. Seven more corps were detached for this purpose and the outcome of the German cam-

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paign against France was no longer in doubt. But these re-enforcements, together with the campaign Germany now began in Poland, saved the Austrian army from annihilation.

The Second Invasion of Poland by Germany.

A second German invasion of Poland in November and December gave the Austrian army, then greatly recovered, an opportunity to undertake an offensive move intended to drive the Russians from the vicinity of Cracow, clear Galicia and raise the siege of Przemysl, but the campaign was a failure, and at its close the Russian armies renewed their advance all the way from Bukowina to Cracow. Early winter found her at the foot of the passes of the Carpathian Mountains gathering her strength for an advance across this barrier to the plains of Hungary. But by February Germany was able to come to Austria's aid with large re-enforcements of new troops, and once more the Teutons assumed the offensive all along the extended southern front. For many weeks the struggle continued along the northern slopes of the Carpathians and in Bukowina and for a time the Russian advance was brought to a standstill or pushed back. But with the surrender of Przemysl, on March 22nd, this weight was removed from the Russian rear, four corps were released for the front, and preparations were at once made for the long-heralded advance in Hungary.

Russia's hosts were now available and for some time they had been concentrating for this grand advance into the heart of Austria. By the end of March they were ready and the movement across the mountain barrier was begun in the dead of winter. Germany, hard pushed on other battlefields, still was able to send fresh corps to help protect the Carpathian passes, but the Russian advance seemed irresistible. The advance began in the last days of March, and by the middle of April it had crossed the mountains and the two weeks of inactivity that followed gave the Teutons a chance to make preparations for the most spectacular and decisive campaign of the war—the campaign that began, May 3rd, with the terrific German drive from Cracow against the Russian flank in the Carpathians, compelled Russia to abandon her invasion of Hungary, drove her armies in rout from the mountains, recovered most of Galicia, inflicted one serious defeat after another on the retreating Russian army, and finally placed the Teuton armies in a favorable position to undertake the final grand climax of the campaign now being fought out about Warsaw.

How Strategic Railways Saved Germany.

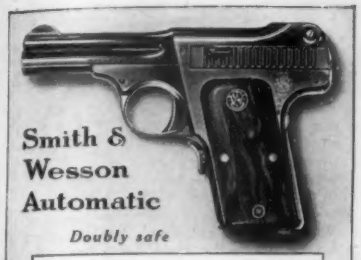
Throughout the war the two great campaigns in the east and west, Germany against France, England and Belgium in one theater, and Russia against Germany and Austria in the other, have exercised a controlling influence on operations in all other theaters, including Poland, East Prussia and Servia, and even the more important operations in Italy and the Dardanelles, for the grand decisive victories that will give victory to one side or the other will be won in one or both of these main theaters, and the main purpose of operations in minor theaters has been to influence the outcome in the two main theaters. This was the object of the first German campaign in Poland. In September, Austria was badly in need of assistance and Germany gave it by advancing east through Poland on Warsaw. The movement began about October 1st and continued successfully for three weeks until the outskirts of Warsaw were reached; here they were attacked on their unprotected left flank, defeated and thrown back. By the latter part of October the German force was in full retreat. The pursuit of the victorious Russians continued throughout the first half of November and was not stopped until they were looking across their frontier into Germany. At the same time the Russians in East Prussia recovered from their earlier severe defeat at Tannenburg, were once more advancing on Koenigsberg, and their armies in Austria were victorious everywhere. This being the situation, Germany was again forced to come to the rescue of Austria. Taking advantage of her wonderful system of strategic railroads along the Polish frontier, she hastily shifted to the north the bulk of the army that had just retreated from in front of Warsaw and began a new campaign against that city about the middle of November. For more than a month the advance continued and for a time it looked as though the Germans would gain a decisive victory; but strong Russian forces were hastily collected in Warsaw, the German army was halted at the Bzura River and then nearly surrounded by the two powerful Russian forces coming in opposite directions from Lodz and Warsaw. No previous crisis in the war had been so serious for the Germans, and only by the greatest skill, together with re-enforcements from the French frontier, were they able to extricate themselves from the ring that was closing around them. The end of December found them driven back once more to their old position.

In the meantime the German advance through East Prussia to the north after the defeat of the Russians at Tannenburg had continued across the frontier to Augustowo, where it was turned back early in October. Through November, December and January the Russians pushed slowly but steadily westward in this region, and once more occupied East Prussian territory. Finally, in the early part of February the Germans assembled a powerful army south of Koenigsberg, covering the concentration by a feigned attack on Warsaw by their army in Poland to the south, attacked the Russians when they were in the difficult region of the Mazurian Lakes and on February 10 gained the most decisive victory of the war, and completely routed the Russian army. After this victory, fighting along the entire front through Poland and East Prussia gradually became of minor importance, but the Germans continued to hold on securely to the territory they had won in anticipation of the time for the great decisive campaign against Warsaw, which is now being waged.

The Entry of Italy.

Italy declared her neutrality in the opening days of the war and immediately there was begun at Rome a hard fought diplomatic struggle between the ablest diplomats the contending powers possessed —one side endeavoring to induce Italy to remain neutral, the other exerting every effort to get her to join in the war. The latter party finally won and Italy joined forces with the Allies in the latter part of May. She had made her preparations most deliberately and was ready to start her armies in motion the moment she declared war. The main routes from Italy into Austria are to the north across the Alps and through the Trentino, and to the east along the northern shores of the Adriatic Sea. Italy's plan was to guard the northern lines of approach with weak forces, while sending the bulk of her forces to invade Austria by the eastern route. For two months she has deliberately and methodically followed this plan. At the Isonzo River on her eastern frontier she was met by the Austrian army supported on powerful fortifications and for weeks she has been hammering at this line. As this is written rumors reach us that Austria's main defensive bulwark at Gorizia is about to fall. Although Italy's own campaign has yet to succeed, it doubtless has greatly influenced events in the eastern theater of war, for who can predict what the outcome in Russia might have been if the Austria army on the Italian frontier had been free to take part in the desperate and successful campaign the Teutons have waged against Russia since the early days of May.

In the last days of October the former German battleships "Goeben" and "Breslau," sailing under the Turkish flag, fired on Odessa in the Black Sea and announced to the world that Germany had at last succeeded in embroiling Turkey in the war. This was the signal for an advance against Turkey from all sides. From the south along the Euphrates River came a British army, and from the north came



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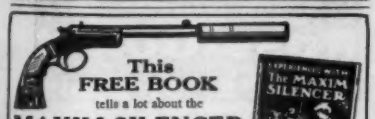

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the Russians, while a second British army gathering at Suez was in a position to move east against the railroad to Mecca; lastly a combined fleet appeared off the Dardanelles. The most severe fighting was in the Caucasus, and culminated on January 4 by an overwhelming defeat of three Turkish corps by the Russians. So far the principal benefit the Teutons had secured from her ally resulted from the closing of the Dardanelles as a supply route for Russia, now limited to Archangel, an ice locked harbor during a large part of the year, and Vladivostok connected to the fighting line by a single track railroad many thousand miles long. To open the Dardanelles and to reach Constantinople, the British and French finally landed an expedition on the narrow Gallipoli peninsula. For months this force has been steadily creeping nearer to the forts that are the key to the peninsula and the straits.

A year ago the assertion frequently was made that the Teutons would meet with their greatest success in the opening months of the war, and that the greater numbers and superior resources of the Allies would soon begin to tell. The truth has turned out to be just the reverse. The Teutons' star was never so dim as during the first few months of the war, and never so bright as now at the end of the first year. Their resources in trained soldiers have been vast enough to enable them as the war progressed to overcome the disparity in numbers and match man for man on the battlefields, while in ammunition and other essential war materials their supplies have been greater than those of the Allies. With a condition of stalemate in France and the Dardanelles, and Italy checked on the Isonzo, while victory perches on the banners of the Teutons in Russia, the beginning of the second year of the great war promises to mark the beginning also of the first decisive stage of the conflict.

Twelve Months of the Great Naval War

(Concluded from page 109.)

the British Isles, submarines have scored no successes against naval vessels.

There is little doubt that it was the menace of the submarine that forced the British main fleet to seek a distant base, remote from the North Sea. Touch is kept with the German coastline, probably by a blockade of submarines, and it may be the presence of these off the German ports which is largely responsible for the absolute German immobility so far as its battleship and battle-cruiser fleet is concerned.

In the Mediterranean this same comparatively new weapon of warfare has demonstrated its efficiency in dramatic fashion. The Austrians have sunk one of the finest of the French armored cruisers and an Italian cruiser, and lately in the Dardanelles the German submarines have accounted for two of the older British battleships, the "Triumph" and "Majestic." The British submarines have sunk two Turkish cruisers and a German cruiser, "Hela," in the North Sea, and the French and Italians have scored frequently in the Mediterranean.

Just here, with regard to the Dardanelles operations as a whole, it should be said that the attempt to force the Straits by a naval demonstration unaided by land forces was one of the worst blunders of the whole war. The first reports of this adventure were optimistic and aroused an expectation of success which was altogether unwarranted by the facts. It has been rumored that the Allies expected Greece to furnish the land army for co-operation; but this has never been substantiated. The present operations promise success after slow and arduous fighting. That the Gallipoli peninsula is being won by the Allies is another tribute to sea power; for every man, every gun and every pound of provisions for the large army there had to be transported by sea and the army itself provisioned and munitioned from the sea. Furthermore, the ships are lending most valuable aid by their flanking fire in assisting the army to conduct its sweeping

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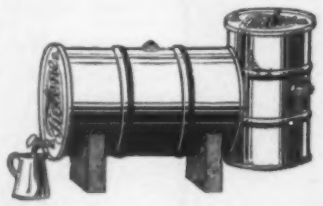

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operations up the peninsula. The submarine scare in this theater of war seems to have subsided. Probably the nets and the destroyer patrol employed around the British Isles are being used to good effect in defense against submarines at the Dardanelles.

Following the failure of the Germans, after their first few successes, to make any impression upon the British naval forces with their submarine fleet, von Tirpitz turned savagely upon the defenseless merchant ships, not merely of the enemy, but of even the neutral nations themselves. Under the positively ridiculous pretense (as the results have shown) that they were blockading the British Isles, they commenced, in contravention of all the rules of warfare and every humanitarian consideration, to sink defenseless ships, and send men, women and children ruthlessly to the bottom—this orgy of crime culminating in the sinking, without warning, of the "Lusitania" with the loss of over 1,000 souls, including over 100 Americans.

But the German submarines are not by any means having things their own way, even in this attack on defenseless ships. So far as stopping food and other importations into Great Britain is concerned, they have not sunk over 2½ per cent of the total tonnage of over 20,000,000 of the British merchant marine. Moreover, although the fact is not publicly known, there has been a terrible loss of German submarines, due to methods of capture and destruction which have been inaugurated since the war began. And instead of the seven or eight reported by the British Admiralty, which represents only those sunk by gunfire, ramming, or other surface attack, there is reason to believe that between thirty-five and forty of the German submarines have been destroyed or netted by the huge series of seining operations around the British Isles. The German submarine is blind below water, and it runs into a heavy steel net as helplessly as a school of fish into a seine net. True it is that Germany is building submarines at a great rate. But it is questionable if she is building them much faster than she is losing them.

The Modern Torpedo

(Concluded from page 114.)

when the gyroscope is finally released, it may not be pointing in the right direction.

In about one tenth of a second it is necessary to store sufficient energy in the gyro-wheel to maintain an effective spin; although a powerful impulse can be impressed upon the wheel certain factors tend seriously toward militating accuracy in shooting. If, for instance, there is any deviation in the pointing of the launching tube at the moment the gyroscope is unlocked, the resulting direction will not be in the true line of sight and the weapon may go wide of its mark. If, on the other hand, the unlocking period is too short, the duration of the spin will suffer.

Again, high speed is obtained at a sacrifice in the range of the torpedo and *vice versa*. The limitations of the present principles of construction are in plain view. In apparent anticipation of this end, inventors have gone faithfully to work devising new methods of propulsion which they believe will produce better results without modifying the general proportions of the present weapons.

Aside from the high initial expense of the compressed air torpedo ($7,000 is the cost of such a weapon) its subsequent charging and recharging is also expensive, when we figure the power expended over a given period of use. Hudson Maxim proposed the use of a self-combustive composition—a slow-burning powder—which was intended to overcome this wastage, but the results obtained in actual experiments do not seem to have been favorable enough to warrant the adoption of the idea. In his weapon a slow-burning charge of a specifically prepared explosive material was ignited in a chamber into which water was injected. Steam was generated which, mixing with the products of combustion, formed the motive fluid. The principle is extremely in-

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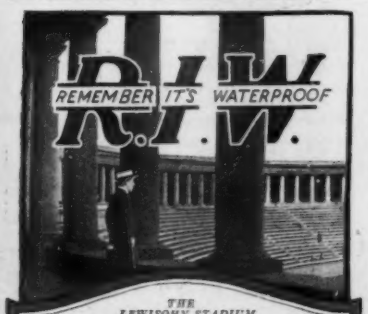

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teresting, but the difficulty of controlling and governing the generation of energy in such a system must always be formidable. There is the possibility of over-generation if the apparatus does not function correctly, resulting in an explosion.

A serious obstacle in the path of those who would depart from the old method of propelling torpedoes by employing gasoline engines, lies in the fact that the torpedo, running as it does several feet under water, must carry its combustion supporting medium. To employ a hydro-carbon engine means the carrying of air or its equivalent, in sufficient quantities to provide a proper mixture of the gas in the engine. It has been proposed to compress air, or better still, oxygen, permitting it to enter a mixing valve, together with the hydro-carbon in measured quantities. To adjust the mechanism to such a nicety that it will automatically give a proper explosive mixture at each stroke is a great difficulty. Variations in temperature, variations in the condition of the fuel, variations in the pressure when delivering the gas or air, all tend to make the problem of driving a submarine torpedo by an internal combustion engine extremely perplexing. Moreover, it must not be forgotten that to drive a large torpedo at the necessary speed requires energy enough to develop approximately 125 horse-power for 15 minutes. If a hydro-carbon engine is to be used we still have the compressed air or gas tank—smaller and working at less pressure to be sure—but still there. Much smaller, however, it can hardly be, particularly if the supply of gas is also to be depended upon for self-starting and for additional energy.

It is obvious that this whole problem is one of propulsion. At present high speed is obtained at a sacrifice in the range of the torpedo and *vice versa*. What is wanted is a method of propulsion which can be brought into action on short notice, and which will remain constant during the entire effective range of the torpedo, and the writer has made promising progress in this direction.

A very promising system of control is that which has been devised by the author, taking into consideration as it does the increased ranges at which ships now fight, and the need for a torpedo which will be fully as effective at a range of fifteen miles as at two.

An elaborate series of researches conducted by the writer several years ago adapted for maintaining the gyroscope's speed of rotation until the weapon had found its mark, which led to the invention of a torpedo which is of the standard length and shape, but in which the gyroscope is spun electrically before the torpedo is launched, and in which energy is continuously supplied to the gyroscopic flywheel throughout the duration of the run.

The electrical gyroscope which the writer has patented can be made very small in size—even smaller, if necessary, than the old Whitehead type, the flywheel of which was about two and one half inches in diameter. The source of current most convenient is a small specially constructed electric accumulator. The whole apparatus, including the source of power, need take up but very little room, is light, self-contained, and easily protected from changes in the temperature, sea water, oil and grit.

The gyroscope is unlocked as usual by the starting latch, but the gyroscope may be started at any time. In order to insure that the gyroscope is spinning when launched, the current is turned on at the time the torpedo is being placed in the launching tube. When the torpedo launching impulse is given, and the starting latch is operated by the movement of the torpedo through the tube, the gyroscope is simultaneously unlocked. This is effected as follows (Fig. 6):

The gyroscope is held in its locked position by means of the usual pin 93, which is held in place by a pawl 94. The spring 95 acts to withdraw the pin after the pawl 94 has been disengaged. The pin 93 is free to slide in the frame or bracket 96 and is provided with a lug 97, which may be engaged by the cam 98. The cam 98 is carried on the shaft 99, which extends

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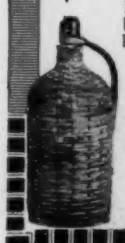

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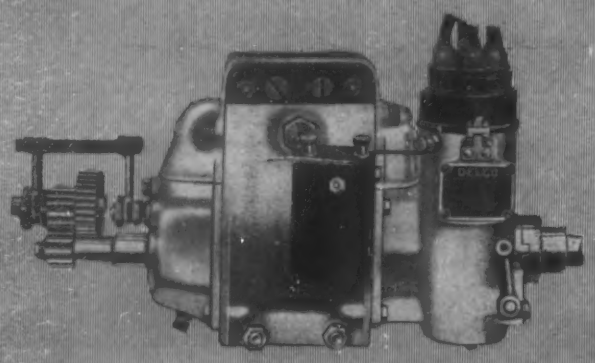

to the shell of the torpedo and can be revolved by means of a key inserted from the outside. When the shaft 99 is thus turned, the cam 98, in revolving, engages the lug 97, consequently forcing the pin 93 into engagement with the socket in the gimbal ring 57. As the cam is further revolved, it is carried out of the path of the lug 97, so that when the pawl 94 is disengaged, the spring 95 is free to withdraw the holding pin 93, thus leaving the gyroscope free.

Associated with the gyroscope in the torpedo is the electrical depth gear, of which 100 is the diaphragm. This diaphragm is connected with a lever 101, fulcrumed at 102, upon which is secured a short arm 103. Attached to the arm 103 extends a coiled spring 104, which can react on the diaphragm for the purpose of opposing pressure to the sea water. The principles of this depth gear are disclosed in a patent application still under prosecution, and cannot, therefore, be further revealed in this article. At the proper time a fuller description will appear in these columns.

Among the more important auxiliary apparatus now operated by air are the motors which control the rudders. The functions of these motors, as we have seen, are governed by small balanced valves, operated in one instance by the gyroscope and in the other by the depth gear apparatus. Electricity permits of the construction of more sensitive apparatus than is possible with air, without necessarily sacrificing ruggedness.

Inadequate as this description of the depth gear must necessarily be, nevertheless it shows that it is possible to construct a depth gear operated electrically without the use of a pendulum. This represents a saving of from fifteen to twenty pounds, to say nothing of the improved functioning of the device and its extreme compactness.

A torpedo equipped with an electrical continuously spinning gyroscope, adapted to be spun in advance, has a peculiar tactical advantage over a torpedo equipped with any other type of gyroscope. It may be fired from alongside a small boat. Thus it would be possible, when necessary to carry the torpedo in a small launch, lay it in the water, start the gyroscope, unlock it at the moment the torpedo is pointed in the right direction, and start the engine. Without any torpedo launching tube it is in this way possible to dispatch a torpedo against an enemy.

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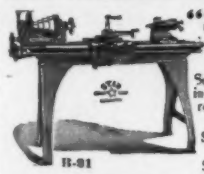

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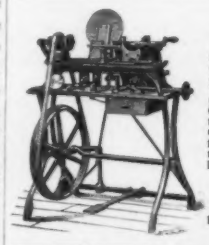

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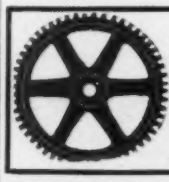

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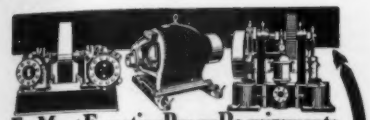

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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13067) W. M. asks: Will you be kind enough to advise me if the sun ever sets on the United States or her possessions? If it does, at what point? A. The best determination we are able to reach from the charts we have, makes the longitude of the eastern point of Maine to be 66 degrees 45 minutes west, and that of the western extremity of the Philippines to be 116 degrees and 40 minutes east longitude. The difference in longitude is then 183 degrees 25 minutes. The 3 degrees and 25 minutes of longitude are 13 minutes 40 seconds of time. Refraction would reduce this time to 9 minutes 8 seconds. So the sun rises on the eastern point of the United States in 9 minutes 8 seconds after it sets on the western point of the Philippines. This is a very little time, and the oratorical claim that the sun never sets on the United States flag is nearer the truth than many such claims.

(13068) H. O. asks if the Bureau of Industrial Research put their services at the disposal of private individuals, and if the Department of Agriculture can supply information about tanning with canaigre roots, also tan wheat as used in the large tanneries in this country. A. The Bureau of Standards at Washington is the only bureau of Industrial Research that we have of an official character. It does not undertake work of all kinds, but it will undertake testing of various kinds. By communicating with the Bureau you will be told what the charges are. The Bureau publishes its results completely in official bulletins and monographs. The information that you specifically seek relating to wheat and tannery can be supplied by the Department of Agriculture. That department has conducted investigations which have been discussed in pamphlets which we believe may be obtained free of charge.

(13069) O. B. asks: I am working on a cement for mending kitchen utensils without solder. In reading the SCIENTIFIC AMERICAN Formula Book I find that water glass and powdered chalk make a good cement, the water glass to be heated to 30 deg. B. What does this mean? I cannot find anybody here who can tell me, not even my druggist. A. 30 deg. B. is not a temperature, but a density. It indicates the Baumé scale of hydrometer. It is probable that "B" should have been "C," and then the Centigrade thermometer scale would have been indicated, corresponding to 86 deg. Fahrenheit. A cement composed of water glass and chalk would not seem to be adapted to take the place of solder for mending kitchenware, which is usually made of tin.

(13070) S. C. H. asks: As a subscriber to the SCIENTIFIC AMERICAN I would be pleased to have your answer to the following query: In electromagnetic calculations for coils, why the distinction between $H = \frac{2\pi IN}{10R}$ for for a circular coil and $H = \frac{4\pi IN}{10L}$ for solenoids? A. In the formula which you give for a circular coil, the H indicates the intensity of the magnetic field and is expressed in gausses. In the formula for solenoids the unit is the gilbert and the formula expresses the magnetomotive force. In this case the length of the coil is taken into account, and two trigonometrical functions cosines enter, which, when the length of the solenoid is great as compared with its diameter, become unity, and their sum is 2, thus giving the 2 times 2, or the 4, of the formula for the solenoid. The gauss is usually represented by H in its script form, and the gilbert by the script letter F, and not as you give it in your letter, where you give both as H.

(13071) M. T. asks: If a bar of steel would be thrown into the ocean at its deepest point, would the steel continue to sink until it reached the bottom, or would it float after reaching a certain depth? A. Any article sinks in water when its weight is greater than that of an equal volume of water. So long as a cubic foot, for instance, of steel weighs more than a cubic foot of water, steel will sink in water. Water is compressed very slightly by pressure. There is an enormous pressure as we descend in the ocean, but the water is not increased to any degree in weight by that pressure. Ocean water usually weighs about 64.25 pounds per cubic foot at the surface and about 67 pounds per cubic foot at the bottom in the deepest places. You see how impossible it is for steel to float at any depth in ocean water. More than that, steel is compressed as it sinks by the pressure of the water upon it, more than the water itself is, so that the steel becomes heavier per cubic foot as it sinks, and that to a higher degree than the water does.

(13072) E. C. D. asks: Is there such a thing as sound-proof glass? A. Glass transmits sound excellently. It has a high elasticity. We hear very well through the glass of the windows. It is in this way that we hear exterior noises when the windows are closed, since the walls of a room do not transmit sound as well as glass does. We should suppose a sound-proof glass could not be made.

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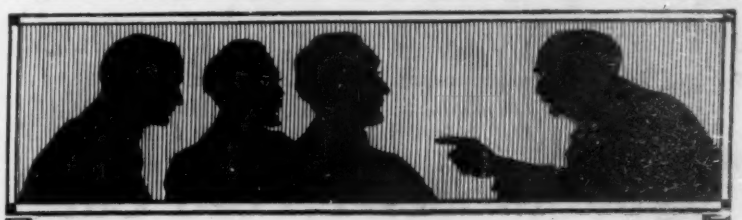

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HANDBUCH FÜR HEER UND FLOTTE. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete. Herausgegeben von Georg von Alten, Generalleutnant z. D. Fortgeführt von Hans von Albert, Hauptmann a. D. Unter Mitwirkung von etwa 400 der bedeutendsten Fachautoritäten: Deutsches Verlagshaus Bong & Co., Berlin.

The present war has undoubtedly heightened the value and interest of this excellent military and naval encyclopedia. That its publication should be continued despite the conflict now raging in Europe is a source of gratification. In the three installments which lie before us we find articles which are particularly timely. The longest article is that on "Literature," which gives one an excellent review of military, naval, and sanitation literature from the earliest times to the present day. This article includes two tables enumerating the military periodicals of all peoples. Very trustworthy and informative are the articles on "London," "Londoner Deklaration," "Luftfahrt" (aeronautics), "Lemberg," "Lille," etc. Some very good maps of great historical value accompany the articles on Leuthen, Liegnitz, Lisaine, Lissa, Lule-Burgas. In an article on Löhnung the systems of payment in vogue among the armies of the world is taken up. The publishers claim that such a comparative study of the soldier's pay in all countries has never been made before.

Instalments 76 to 78 of this Handbuch are of peculiar interest to those who are following the war. In an article entitled "Maas und Mosel Befestigungen" the development of the fortifications on Germany's western frontier since 1871 and the part that they are playing in the present conflict is brought out. An excellent map accompanies the article upon which are traced all the principal Belgian, French and German fortifications, including Liége, Namur, Givet, Mézières, Longwy, Verdun, Toul, Epinal Metz, Diedenhofen. In an article on Malta, the part played by this important naval base in England's Mediterranean policy is taken up. Oberleutnant von Stuckrad, who was killed during the present war and in whom German military literature has lost a most able and conscientious writer, critically discusses the naval administration of the various powers. Fron his exhaustive catalogue of the marine ministers, secretaries of state, etc., of the various powers, we learn that France has had no less than 134 marine ministers. Capt. Albrecht, another military writer who has fallen during the war and who was a prominent member of the Prussian general staff, has compared the marching performances of armies in all war epochs of the world's history. Major Fleck presents a most illuminating picture of the machine gun as it is employed in the chief armies of the world. The Handbuch is a tribute to the German publishing house which is issuing this valuable work and a tribute to the army officers who have made it the authoritative reference book that it is, all the more so since its publication, so far from being interrupted during these troublous times, is continued as vigorously as if there were no war at all.

DER MENSCH DER ZUKUNFT. Von Wilhelm Boelsche. Kosmosgesellschaft der Naturfreunde. Franckh'sche Verlagshandlung, Stuttgart.

In this little volume Boelsche applies the theories of evolution to mankind and gives us an excellently drawn picture of what the future holds out for us on the basis of past biological history. Written in very flowing and graceful German, Boelsche's book should be read with interest by those who take an interest in popular biology.

OXY-ACETYLENE WELDING AND CUTTING. Including the Operation and Care of Acetylene Generating Plants and the Oxygen Process for Removal of Carbon. By Calvin F. Swingle, M.E. Chicago: Frederick J. Drake & Co., 1915. 16mo.; 190 pp.; illustrated. Price, cloth, $1; leather, $1.50.

The advantages offered by the oxy-acetylene method of welding are coming into general recognition; the many metals amenable to the process, and the strength developed by it, appeal strongly to the practical man, be he of the machine shop, the smithy, the boiler shop, the repair shop, or the garage. Every point of practical importance, and much theory, is covered by the little volume in hand. It carries concise descriptions of the various kinds of welding, and plainly sets forth the advantages and the disadvantages of each method. Oxy-acetylene cutting, and the operation of the multiple-jet torch, is touched upon. A brief discussion of the oxygen process for the removal of carbon concludes a very helpful work.

THE INTERPRETATION OF HISTORY. By L. Cecil Jane. New York: E. P. Dutton & Co., 1915. 8vo.; 357 pp. Price, $1.75 net.

Theories of history, its meanings, and its elements of conflict, are carefully developed by the author The conflict in Europe, from Hellenic times down to the present day, is viewed from all angles. Finally, modern tendencies are summarized, and an appendix deals with the present war and its probable results and influences. The author regards it as the function of the historian to reveal as much as possible of the future in making known the lessons of the past. To this task it is necessary to bring a definite principle of interpretation, and it is this explanatory factor which Mr. Jane essays to furnish. He finds the true motive in individual conduct to be that of desire. He declares the conduct of states to be regulated by the same factor, and he reduces history to the record of a conflict between the desire to be ruled and the desire to rule. It is in the search for happiness that we find the key to progress and retrogression, to war and peace, to the swing of the pendulum between tyrannous oligarchy and corrupt democracy.

LATHES. Their Construction and Operation. By George W. Burley, Wh. Ex., A.M.I. Mech. E. New York: D. Van Nostrand Company, 1915. 12mo.; 244 pp.; 200 illustrations. Price, $1.25 net.

"Lathes" is a succinct survey of modern lathe construction and operation, with the greater space properly enough devoted to those aspects which are of most importance. It is essentially descriptive, and clear illustrations are freely used in presenting the various types, their parts, and accessories. To engineering students and apprentices the monograph offers just such information as they will require, and even the older hand may glean from it points which otherwise he might be apt to overlook.

TRATTATO DI COSTRUZIONI ANTISISMICHE. Preceduto da un Corso di Sismologia. F. Masciari-Genoese. Milano: Ulrico Hoepli, 1915. 8vo.; 1004 pp.; con 900 figure nel testo. Prezzo, L. 24.

The latest great earthquake in Italy produced much fugitive literature on the subject of earthquake-resisting construction; but it has remained for the author of "Costruzioni Antisismiche" to amplify these ideas and to present them in an enduring form. His work first treats of seismology, setting forth the principles, the facts, and the progress of this science. With this knowledge as a foundation, the reader is better prepared to understand and appreciate the main body of the work, which discusses in detail many types of building adapted to withstand to the utmost the violence of earthquake shocks. Various building materials are considered, and the whole research and its presentation is thorough and trustworthy.

FINANCING AN ENTERPRISE. A Manual of Information and Suggestion for Promoters, Investors, and Business Men Generally. By Francis Cooper. New York: The Ronald Press, 1915. 8vo.; 524 pp. Price, $3.

This is a fourth edition. As its author remarks, while the principles of finance do not change, their applications do, and illustrations become obsolete and must be replaced. The general purpose of the book is to assist in honest promoting. To this end it goes beyond the actual financing of a business, and deals also with its investigation, valuation, and preparation and presentation. The important matter of capitalization is not neglected. Since two individual standpoints are always involved in financing—that of the man with the proposition and that of the man with the money—both these standpoints are kept in view, and means discussed for bringing them together. An appendix is devoted to "the investor's questions," which covers all inquiries that the man of money is likely to make, and is thus of the highest value in assisting the man of need to prepare satisfactory answers; for this is a case where well-arranged and convincing expression is as necessary as an honest and promising proposition behind that expression. Indeed, financing has frequently been successful without the aid of the latter, but never without that of the former.

EFFECTIVE BUSINESS LETTERS. Their Requirements and Preparation. With Specific Directions for the Various Types of Letters Commonly Used in Business. By Edward Hall Gardner. Assistant Professor of English in the University of Wisconsin. New York: The Ronald Press Company, 1915. 8vo.; 376 pp. Price, $2.

The importance of the letter in business has come to be unquestioned. That it should be immaculate in appearance and phrased in good, plain English is universally admitted. When, however, we come to the finer points of appeal, opinions and usages frequently differ. Prof. Gardner has at least made the issue a practical one in that he has drawn upon the experiences of successful firms, studying and using their actual correspondence. Clearness, conciseness, completeness and courtesy should all be embodied in the perfect letter. Letters of adjustment, of credit, of collection, and of sales receive skilled attention, bad and good practice is contrasted side by side, and the principles of effective writing are deftly summarized.

A TEXT BOOK ON WELDING AND CUTTING METALS BY THE OXY-ACETYLENE PROCESS. Minneapolis, Minn.: Vulcan Process Company, 1915. 8vo.; 134 pp.; 64 illustrations. Price, $1.50.

In this text we have a practical instruction book for mechanics and autogenous welders. It avoids technical detail and is concise rather than comprehensive. There are preliminary chapters in chemistry, physics and metals, but they convey only the most elementary and necessary facts—quite sufficient, however, to bring the welder to his task with an adequate mental equipment. The various types of generators are described and illustrated, the welding and cutting torches are shown in their different forms and adaptations, pressure regulators are explained, and the steps essential to the successful equipment and operation of a welding shop are given. The approved methods of welding under differing conditions and demands are very plainly imparted, and it is made clear why some welds are failures and others unqualified successes. The latter portion of the treatise as thoroughly deals with the cutting of metals by means of the oxygen jet, and with oxygen burning as a substitute for scraping in the removal of carbon from the cylinders of internal combustion engines. Altogether the work is most satisfactory from a practical point of view, and will prove greatly helpful to welders, boilermakers, automobilists, and others.

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At every point you will find ***better*** workmanship—***finer*** materials—***handsomer*** appointments.

We have deliberately set out to make the "Fairfield" the last word in six-cylinder elegance and luxury. We have spared neither pains nor money to accomplish our purpose.

When you actually ***see*** the new features you will find it difficult to reconcile so much real value with the greatly decreased price.

Once again you will be forced to admit that Paige has created a new standard by which moderate priced cars must be judged.

Remember, there has never been a single week when the factory could begin to keep step with its orders since this great motor car was announced last January.

Despite our greatly increased manufacturing facilities and doubled production, there is every indication that the overwhelming demand for the "Six-46" will continue.

We suggest, therefore, that you act quickly in placing your order.

Paige Hollywood
5-passenger "Six-36"
$1095

Paige-Detroit Motor Car Company, 1210 McKinstry Avenue, Detroit, Michigan

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